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FINAL
DECISION DOCUMENT
AREEs 9, 11, 19, AND 21
VINT HILL FARMS STATION
WARRENTON, VIRGINIA

Prepared for:
U.S. Army Communications-Electronics Command

Prepared by:
IT Corporation
Edgewood, Maryland

June 1999

TABLE OF CONTENTS

Section **Page**

1.0 INTRODUCTION 1

2.0 SITE BACKGROUND 1

3.0 SITE CHARACTERISTICS 4
- 3.1 Site Topography 4
- 3.2 Adjacent Land Use 4
- 3.3 Surface Water Hydrology 4
- 3.4 Geology/Hydrogeology 4

4.0 SITE HISTORY AND INVESTIGATION FINDINGS
- 4.1 AREE 9 - Vehicle Maintenance Area 5
- 4.2 AREE 11 - Former Sewage Treatment Plant 5
- 4.3 AREE 19 - Pistol Range 5
- 4.4 AREE 21 - Sand Filter Beds 9

5.0 SUMMARY OF SITE RISKS 9
- 5.1 AREE 9 - Vehicle Maintenance Area 12
- 5.2 AREE 11 - Former Sewage Treatment Plant 12
- 5.3 AREE 19 - Pistol Range 12
- 5.4 AREE 21 - Sand Filter Beds 13

6.0 REMEDIAL ACTION OBJECTIVES 13

7.0 CLEANUP LEVELS ESTABLISHED FOR THE SELECTED ALTERNATIVE 14

8.0 SUMMARY OF REMEDIAL ALTERNATIVES 14
- 8.1 Alternative 1 - No Acton 14
- 8.2 Alternative 2 - Soil Removal 14

9.0 EVALUATION OF ALTERNATIVES
- 9.1 Overall Protection of Human Health and the Environment 16
- 9.2 Compliance with ARARs 16
- 9.3 Long-term Effectiveness and Permanence 17
- 9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment 17
- 9.5 Short-term Effectiveness 17
- 9.6 Implementability 17
- 9.7 Cost 17
- 9.8 Regulator Acceptance 17
- 9.9 Community Acceptance 18

10.0 SELECTED REMEDY AND STATUTORY DETERMINATIONS 18
- 10.1 Selected Remedy 18
- 10.2 Statutory Determinations 18
  - 10.2.1 Protection of Human Health and the Environment 18
  - 10.2.2 Compliance with ARARs 19
  - 10.2.3 Cost-Effectiveness 19
  - 10.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable 19
  - 10.2.5 Preference for Treatment as a Principal Element 19

TABLE OF CONTENTS (Continued)

Section		Page
11 .0	HIGHLIGHTS OF COMMUNITY PARTICIPATION	19
12.0	RESPONSIVENESS SUMMARY	20
12.1	Selected Newspaper Notices	20
12.2	Comments Raised During the Public Meeting on September 18, 1997	20
12.3	Public Meeting Attendance Roster	21
12.4	Restoration Advisory Board Members	21
13.0	REFERENCES	22

LIST OF FIGURES

Figure		Page
1	General Location of VHFS	2
2	General Locations of AREEs at VHFS	3
3	Sl and Rl Sampling Locations for AREE 9 - Vehicle Maintenance Area	6
4	Sl and RI Sampling Locations for AREE I I - Former Sewage Treatment Plant	7
5	Sl and RI Sampling Locations for AREE 19 - Pistol Range	9
6	Sl and RI Sampling Locations for AREE 21 - Sand Filter Beds	10

LIST OF TABLES

Table		Page
1	Cleanup Levels Established for Soils at the Four AREES	15

LIST OF ATTACHMENTS

Attachment 1	Proposed Plan
Attachment 2	Cleanup Level Development Documents
Attachment 3	Public Notice

ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
AREE	Area Requiring Environmental Evaluation
bgs	below ground surface
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
CECOM	Communications-Electronics Command
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
DD	Decision Document
EEQ	environmental effects quotient
ENPA	Enhanced Preliminary Assessment
ERA	Ecological Risk Assessment
FS	Feasibility Study
ft	feet
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
ICF KE	ICF Kaiser Engineers, Inc.
IEUBK	Integrated Exposure Uptake Biokinetic
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PAH	polynuclear aromatic hydrocarbon
ppm	parts per million
RBC	risk-based concentration
RI	Remedial Investigation
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
STP	sewage treatment plant
TPH	total petroleum hydrocarbon
TRV	toxicity reference value
USAEC	U.S. Army Environmental Center
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VHFS	Vint Hill Farms Station

DECLARATION FOR THE DECISION DOCUMENT
REMEDIAL ALTERNATIVE SELECTION

Site Name and Location

Areas Requiring Environmental Evaluation (AREEs) 9, 11, 19, and 21
Vint Hill Farms Station
Warrenton, Virginia

Statement of Basis and Purpose

This Decision Document (DD) presents a determination that no action is necessary to protect human health and the environment for soil at AREE 21. In addition, this DD presents the selected remedial action for soil at AREEs 9, 11, and 19 at Vint Hill Farms Station (VHFS), Warrenton, Virginia, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. This document was prepared as a joint effort between the U.S. Army, the Virginia Department of Environmental Quality (VDEQ), and the U.S. Environmental Protection Agency (USEPA). The no action and remedial action decisions are based on documents contained in the Information Repository.

Assessment of the AREEs

Actual or threatened releases of hazardous substances from AREEs 9, 11, and 19, if not addressed by implementing the remedial action selected in this DD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The selected remedial action addresses the principal threat at AREEs 9, 11, and 19 by the excavation of contaminated soil and off-site disposal at a permitted facility. No action is the selected remedy for AREE 21 since the established soil cleanup level is higher than the maximum detected contaminant concentration.

Statutory Determinations

The selected remedy (i.e., no action for AREE 21; and remedial action for AREEs 9, 11, and 19) is protective of human health and the environment, complies with Federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for AREEs 9, 11, and 19. However, because treatment of the principal threat at AREEs 9, 11, and 19 was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. A five-year review will not be necessary for AREEs 9, 11, 19, and 21 since the selected remedy will result in levels of contamination at or below risk-based cleanup levels.

Robert L. Nabors

7/1/99
Date

ROBERT L. NABORS
Major General, USA
Commanding
U.S. Army Communications-Electronics Command

DECISION SUMMARY

1.0 INTRODUCTION

The remedial action decision is based on the Phase I Reuse Area Remedial Investigation (RI) Report (USAEC, 1998) which includes a Baseline Risk Assessment (BRA) documenting the risks from contamination in the soils at Areas Requiring Environmental Evaluation (AREEs) 9, 11, 19, and 21. In the BRA, it was determined that the soils at AREEs 11, 19, and 21 pose unacceptable risks to human health and/or the environment. In addition, total petroleum hydrocarbon (TPH) concentrations in soil at AREE 9 exceed the Virginia TPH soil action level for underground storage tanks (USTs). Therefore, the soils at AREEs 9, 11, and 19 require remedial action to be protective of human health and the environment. However, upon establishing cleanup levels, it was determined that no action is necessary to protect human health and the environment for soil at AREE 21 because the cleanup level is higher than the maximum detected contaminant concentration.

A feasibility study (FS), which develops and examines remedial action alternatives for a site, was performed for AREEs 9, 11, and 19 and presented in the Proposed Plan (see Attachment 1).

2.0 SITE BACKGROUND

Vint Hill Farms Station (VHFS) is part of the U.S. Army Communications - Electronics Command (CECOM) and, while active, primarily functioned as an Army installation engaged in communications intelligence. VHFS is located approximately 40 miles southwest of Washington, D.C., in Fauquier County, Virginia, as shown on Figure 1. The installation occupies approximately 701 acres of land near the town of Warrenton, Virginia. Approximately 150 acres of the installation are improved grounds in the southern portion of the property used for industrial operations, administration buildings, and residential housing. Approximately 94 acres in the eastern portion of the property are mature hardwood forest, and the majority of the remaining 457 unimproved and semi-improved acres in the northern portion of the property are used for stationary and mobile antenna operation sites.

VHFS was designated for closure in March, 1993, under the Base Realignment and Closure (BRAC) Act. Pursuant to the decision to close the installation, an Enhanced Preliminary Assessment (ENPA) and a Community Environmental Response Facilitation Act (CERFA) investigation of VHFS were conducted by Science Applications International Corporation (SAIC) to assess the environmental condition of the installation. The ENPA and CERFA investigations were completed in April and May, 1994, respectively. The ENPA identified 42 AREEs from the review of installation records, aerial photographs, installation personnel interviews, federal and state regulatory records, and visual inspection. Of these 42 AREEs, 27 were recommended for further investigation.

These 27 AREEs were investigated from September, 1994, to June, 1995, as part of the Site Inspection (SI) conducted by SAIC. The objective of the Sl was to determine the presence or absence of contamination and the chemical nature of any detected contamination. The final SI Report (USAEC, 1996), which was completed in June, 1996, identified 24 AREEs which required further investigation. In addition, four new AREEs were identified during site reconnaissance to warrant further investigation subsequent to the SI. AREEs that were determined to warrant further investigation and are located in the Phase I reuse area (shown on Figure 2) were investigated between April and June, 1996, as part of the Phase I reuse area RI conducted by ICF Kaiser Engineers, Inc. (ICF KE). The purposes of the RI were to evaluate: 1) the nature and extent of contamination; and 2) the level of risk posed to human health and the environment. The final RI Report for the Phase I reuse area (USAEC, 1998) was completed in April, 1998.

Four AREEs were identified in the Rl as having soil contamination which poses unacceptable human health risks and/or significant adverse ecological effects:

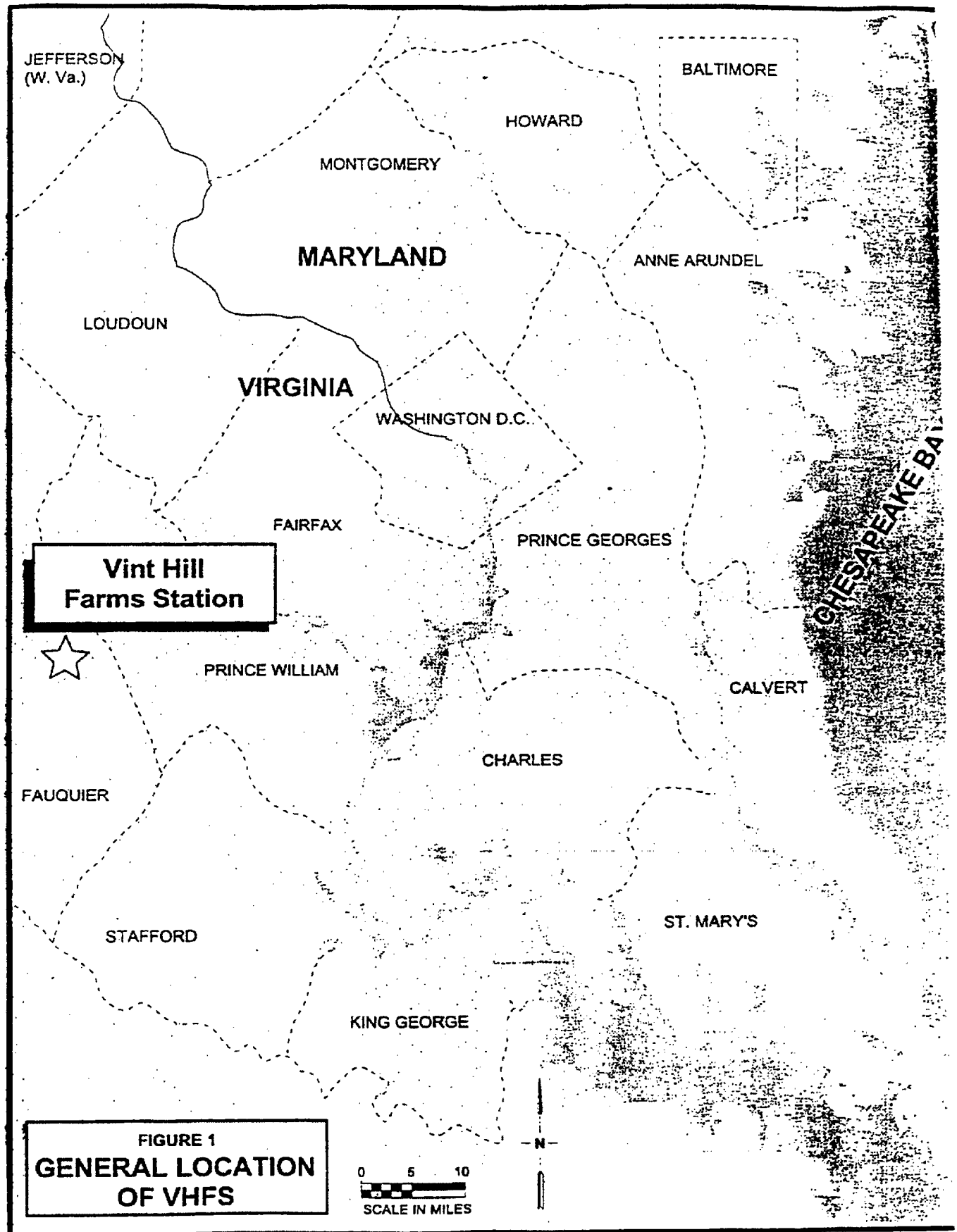


FIGURE 1
GENERAL LOCATION OF VHFS

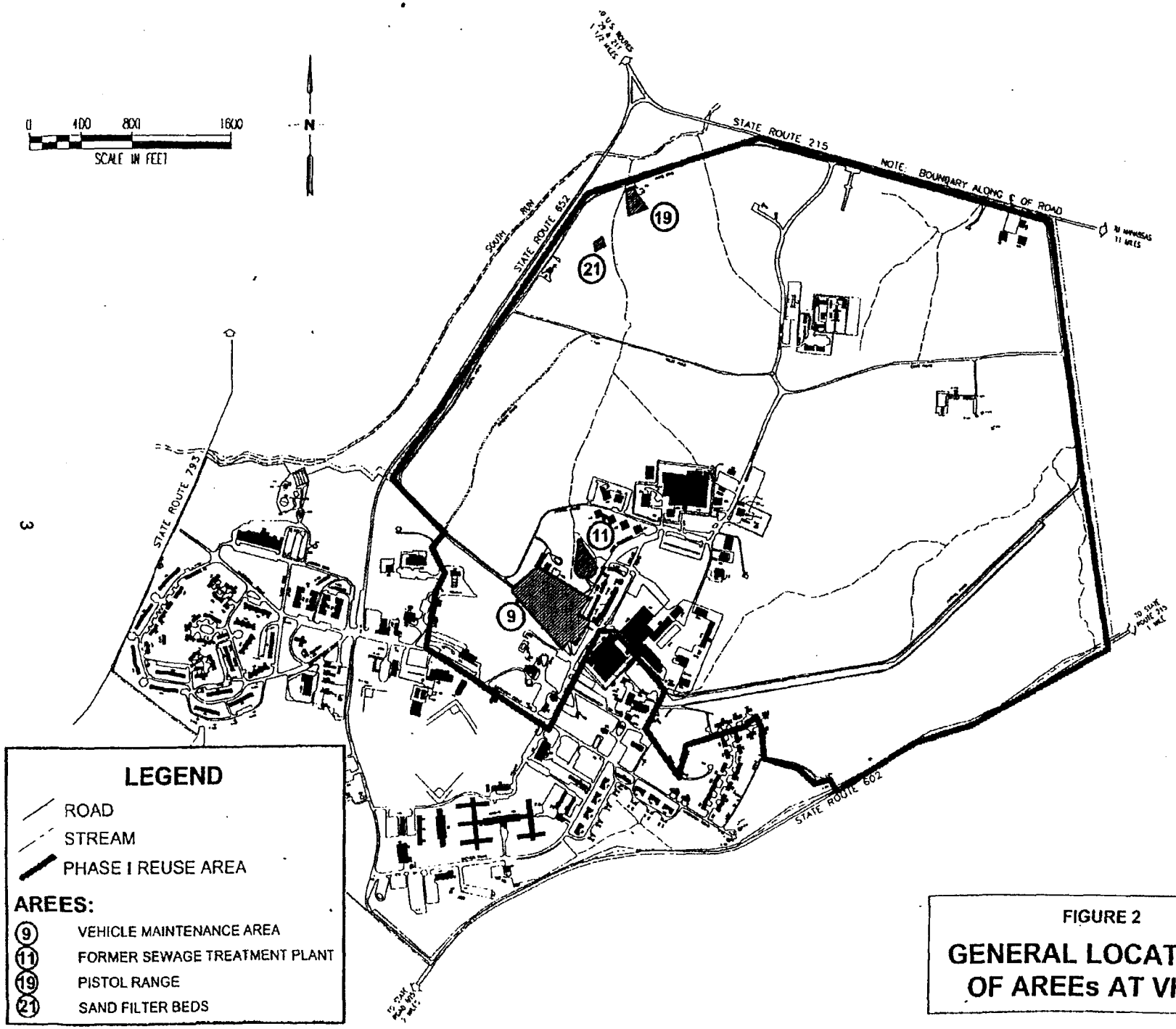


FIGURE 2

GENERAL LOCATIONS OF AREEs AT VHFS

- AREE 9 - Vehicle Maintenance Area;
- AREE 11 - Former Sewage Treatment Plant;
- AREE 19- Pistol Range; and
- AREE 21 - Sand Filter beds.

The locations of these AREEs are shown on Figure 2.

3.0 SITE CHARACTERISTICS

3.1 Site Topography

VHFS is located within the Piedmont Plateau physiographic province, approximately 20 miles west of the Fall Line. The Fall Line is a physiographic boundary that separates the folded and faulted crystalline rocks of the Piedmont Plateau physiographic province from the unconsolidated sediments of the Atlantic Coastal Plain physiographic: province. The topography of the Piedmont Plateau in the vicinity of VHFS consists of gently rolling hills with slopes generally less than 10%. Surface elevations on the installation vary from 335 to 430 feet (ft) above mean sea level (MSL).

3.2 Adjacent Land Use

Land use in the immediate vicinity of VHFS consists mainly of agriculture (mostly horse farms) and residential areas. With the exception of a few residences to the north, the majority of residential development is located to the south of VHFS. A small county recreation park is located adjacent to VHFS along South Run.

3.3 Surface Water Hydrology

VHFS is located in the Occoquan watershed. Most of VHFS drains to South Run via intermittent tributaries and drainage ditches, as shown on Figure 2. South Run is a small Class III Virginia stream which discharges into Lake Manassas, a recreation and drinking water reservoir built on Broad Run for the City of Manassas. Lake Manassas discharges to Broad Run, which drains to the Occoquan Reservoir. Drainage for the southern portion of the installation flows south and east to Kettle Run. Kettle Run converges with Broad Run approximately 10 miles downstream from Lake Manassas.

3.4 Geology/Hydrogeology

The central portion of VHFS is underlain by folded sedimentary rocks of the Catharpin Creek Member which consists of sandstone, arkosic sandstone, siltstone, shale, and claystone. Intrusions of basalt, oriented northeast to southwest, cut the bedrock in the central and western portions of the VHFS installation. The northeastern flank of VHFS is underlain by intrusions of diabase. Quaternary alluvium is present along the major drainage channels within the installation.

The overburden, is thickest (20-40 ft) in the southern regions of the site and thins to 0-10 ft in the northern areas. The overburden consists primarily of saprolite (a chemical and physical weathering product of the underlying bedrock) which underlies lesser amounts of clayey and silty soils.

Groundwater at VHFS occurs in fractured bedrock and to a lesser extent in the overburden. The bedrock aquifer is semi-confined, with the unfractured bedrock and saprolite acting as confining units. Recharge to the fractured bedrock aquifer occurs at outcrop areas and from percolation from the overburden along fractures. In the overburden, the aquifer is unconfined.

4.0 SITE HISTORY AND INVESTIGATION FINDINGS

The RI for these four AREEs was conducted to evaluate the nature and extent of contamination associated with past site activities. Environmental samples collected and analyzed during the RI were used in conjunction with the results from the SI to assess the condition of each of the AREEs. The environmental media investigated included surface soil (0 to 2 ft below ground surface [bgs]), subsurface soil (2 ft to approximately 12 ft bgs), surface water, sediment, and groundwater, Analytical results were compared to background concentrations and regulatory screening levels to determine if environmental media had been adversely impacted by site activities. A brief description of each of the four AREEs and the significant findings of the RI and SI are presented in the following paragraphs. A detailed presentation of the samples collected and the analytical results can be found in the Phase I Reuse Area RI Report (USAEC, 1998), available in the Information Repository.

4.1 AREE 9 - Vehicle Maintenance Area

AREE 9 is an area used for general maintenance of military, government, and private vehicles. Small spills of oil, grease, gasoline, and cleaning solvents have been reported on the asphalt areas within the AREE. Neutralization pits (approximately 3 ft x 3 ft x 4 ft deep) which receive wastewater from the sinks within the Civilian Motor Pool (Building 288) and the Military Motor Pool (Building 290) are located outside each building. The Civilian Motor Pool neutralization pit has a cement bottom, and the Military Motor Pool neutralization pit has an earthen bottom.

Surface soil, subsurface soil, sediment, surface water, and groundwater samples were collected at AREE 9 as shown on Figure 3. TPH contamination, exceeding the Virginia TPH soil action level for USTs of 100 parts per million (ppm), is present in subsurface soil beneath the Military Motor Pool neutralization pit (which has an earthen bottom). The highest TPH concentration (8,440 ppm) was detected at the base of the neutralization pit. The TPH contamination extends to bedrock at approximately 8.5 ft bgs, and decreases with depth.

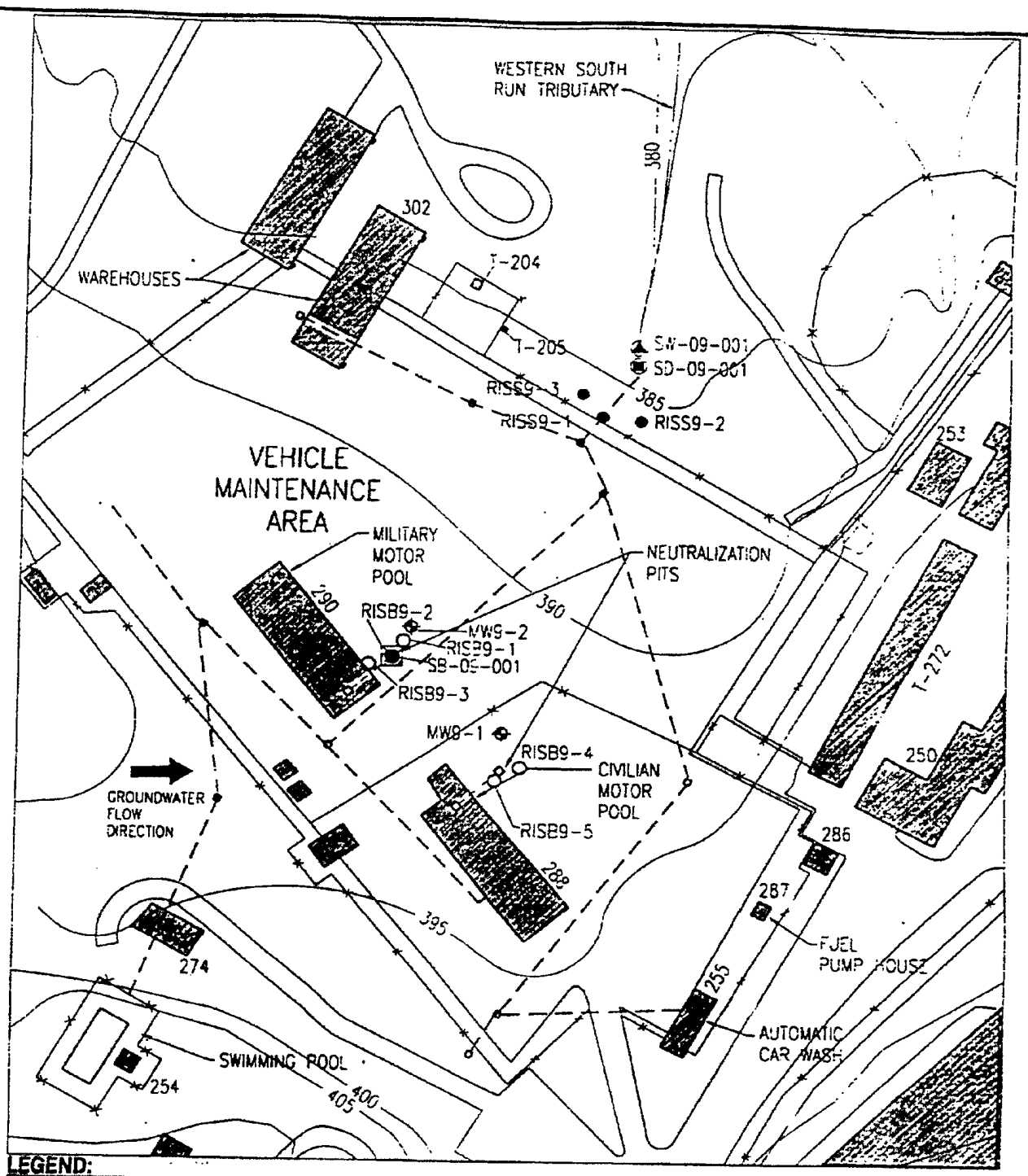
4.2 AREE 11 - Former Sewage Treatment Plant

AREE 11 is the site of the former Sewage Treatment Plant (STP). The former STP was active from 1948 to 1981, and was used to treat wastewaters from VHFS activities, including industrial wastewaters from photographic, painting, laboratory, vehicle washing, and metal etching operations. The sludges from the treatment process were dried on drying beds and stored in sludge piles. The locations of these areas are shown on Figure 4.

Shallow and deep surface soil samples were collected in the vicinity of the drying beds and sludge piles. Groundwater samples were collected downgradient of these areas. Polynuclear aromatic hydrocarbon (PAH) contamination, exceeding residential soil Risk-based Concentrations (RBCs) established by the U.S. Environmental Protection Agency (USEPA) Region III for screening of analytical results, is present in the surface soil in the drying bed area and the sludge pile area. Pesticide contamination, exceeding residential soil RBCs, is present in the surface soil in the drying bed area and the sludge pile area. Mercury contamination, exceeding the residential soil RBC, is present in the surface soil in the sludge pile area.

4.3 AREE 19 - Pistol Range

AREE 19, the Pistol Range, has been in use since 1961 for limited target practice using .22, .32, .38, and .45 caliber handguns. The firing fan is directed southward toward a horseshoe-shaped impact berm, which captures the bullets. The layout of the Pistol Range is shown on Figure 5. Spent ammunition was not recovered, but shelf casings were collected and returned to the fixed ammunition magazine.



LEGEND:

- BUILDING
- FENCE
- ROAD
- STREAM
- 380 TOPOGRAPHIC CONTOUR (FT MSL)
- CATCH BASIN W/SANITARY SEWER
- SI SURFACE WATER SAMPLE LOCATION
- SI SOIL BORING LOCATION
- SI SEDIMENT SAMPLE LOCATION
- RI SURFACE SOIL SAMPLE LOCATION
- RI SOIL BORING LOCATION
- RI GROUNDWATER MONITORING WELL
- IMPACTED SOIL AREA (APPROXIMATE)

N

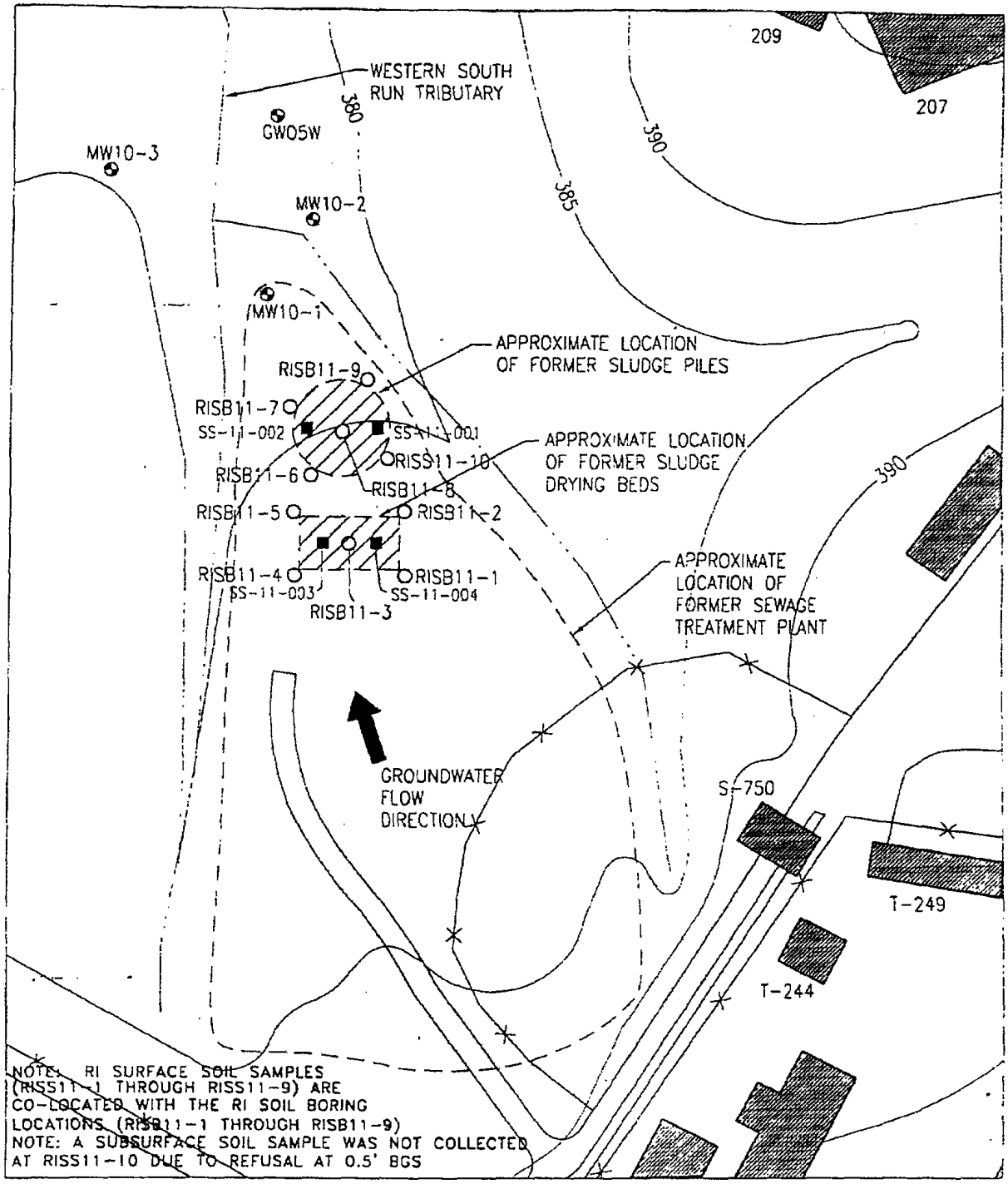
0 50 100

SCALE IN FEET

FIGURE 3

SI AND RI SAMPLING LOCATIONS FOR AREE 9 VEHICLE MAINTENANCE AREA

AREE9



LEGEND:

- BUILDING
- FENCE
- ROAD
- STREAM
- 380 TOPOGRAPHIC CONTOUR (FT MSL)
- SI SURFACE SOIL SAMPLE LOCATION
- RI SOIL BORING LOCATION
- GROUNDWATER MONITORING WELL
- IMPACTED SOIL AREA (APPROXIMATE)

N

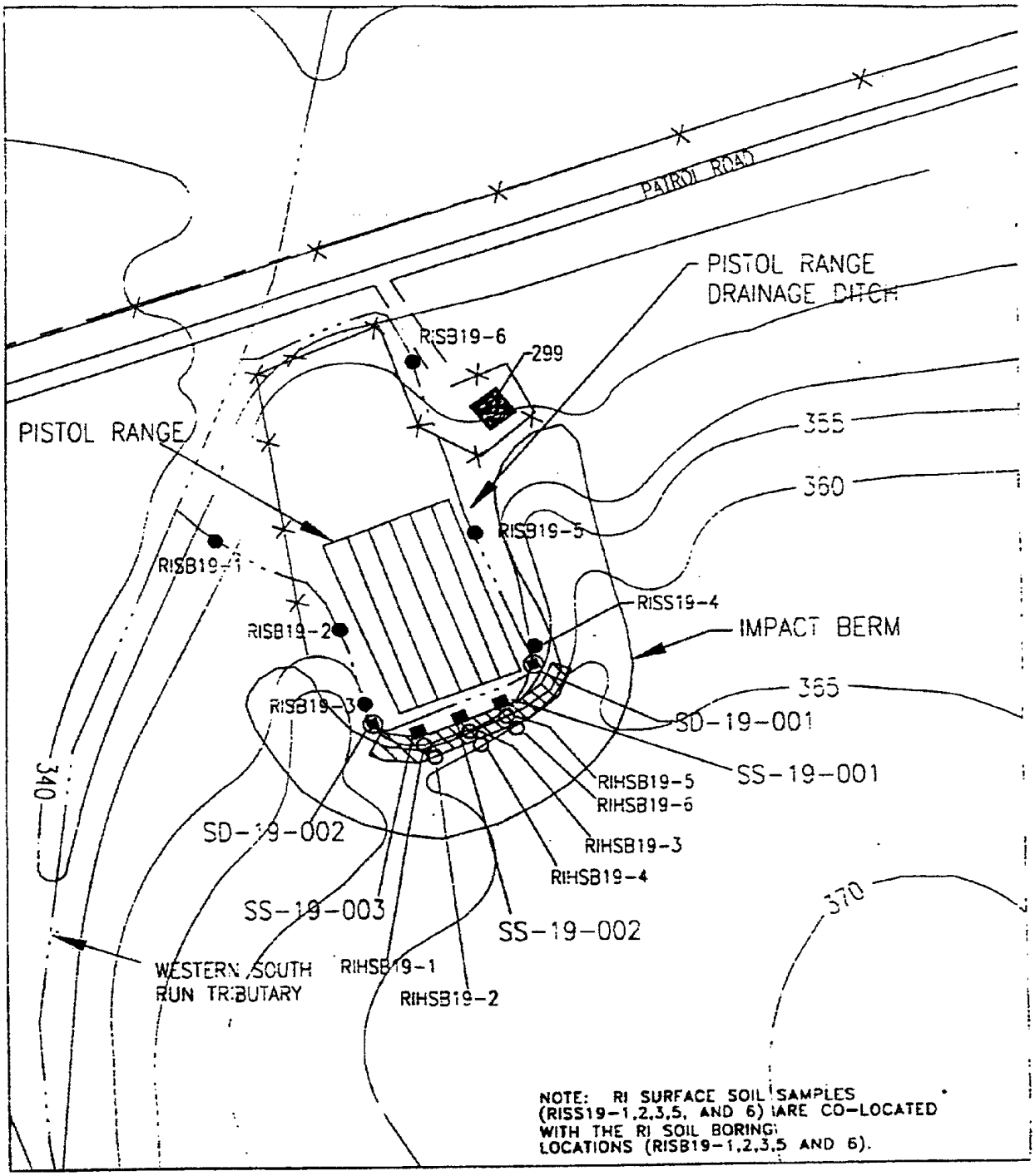
0 30 60

SCALE IN FEET

FIGURE 4

SI AND RI SAMPLING LOCATIONS FOR AREE 11 - FORMER SEWAGE TREATMENT PLANT

AREE11



LEGEND:

- BUILDING
- FENCE
- VHFS BOUNDARY
- PAVED ROAD
- STREAM
- 390 TOPOGRAPHIC CONTOUR (FT MSL)
- SI SURFACE SOIL SAMPLE LOCATION
- SI SEDIMENT SAMPLE LOCATION
- RI SURFACE SOIL/SOIL BORING LOCATION
- RI HORIZONTAL SOIL BORING LOCATION
- IMPACTED SOIL AREA (APPROXIMATE)

N

0 50 100

SCALE IN FEET

FIGURE 5
SI AND RI SAMPLING LOCATIONS FOR AREE 19 PISTOL RANGE

AREE19

Surface soil, subsurface soil, and sediment samples were collected from the impact berm and surrounding area. Lead contamination, exceeding USEPA's screening level of 400 ppm for lead in soil for residential use, is confined to the surface soil of the impact berm. The highest concentrations of lead (up to 5,850 ppm) were detected within the first six inches of the impact berm. Lead concentrations in the samples collected deeper into the impact berm were generally one to two orders of magnitude lower than those at the surface and were all less than 400 ppm.

4.4 AREE 21 - Sand Filter Beds

The Sand Filter Beds (AREE 21) were used to filter ash wastewaters from the wet scrubber, which was used for particulate control in the installation incinerator smokestack. The two beds, constructed with concrete walls and an unlined bottom, utilized coarse sand and filter gravel to filter particulates from the wastewater. An underdrain system in the gravel drained the effluent to a distribution box. The effluent then discharged through a perforated pipe to an absorption field north of the Sand Filter Beds.

Surface soil samples were collected from the Sand Filter Beds and along the absorption field. Groundwater samples were collected in the vicinity and downgradient of the Sand Filter Beds and absorption field as shown on Figure 6. Dioxin/furan contamination, exceeding residential soil RBCs, is present in surface soil near the Sand Filter Beds and along the absorption field.

5.0 SUMMARY OF SITE RISKS

A BRA was conducted as part of the RI to assess the human health and ecological problems that could result if the contamination at the AREEs was not remediated. The Human Health Risk Assessment (HHRA) was prepared to evaluate the magnitude of potential adverse effects on human health associated with current industrial/commercial and potential future residential exposures to site-related chemicals at the AREEs. The Ecological Risk Assessment (ERA) was conducted to characterize the potential threats to ecological receptors posed by contaminants at the AREEs.

The HHRA follows a four-step process:

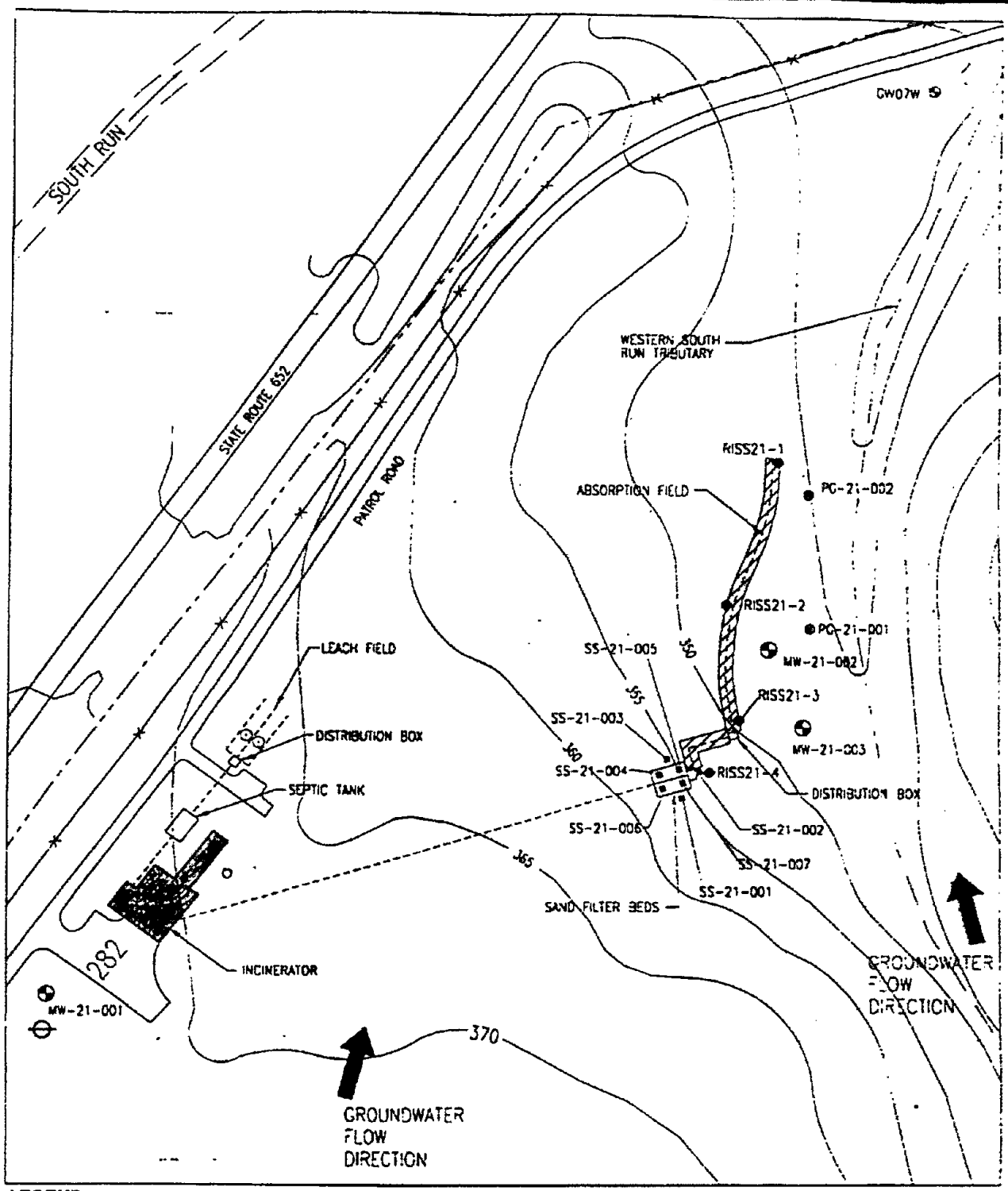
- Selection of Chemicals of Potential Concern - identifies the contaminants of potential concern based on their toxicity, frequency of occurrence, and concentration by comparing the maximum concentrations of detected chemicals with RBCs which are health-protective chemical concentrations that are back-calculated using toxicity criteria, a $1x10^{-6}$ target carcinogenic risk or a 0.1 hazard quotient (HQ, defined below), and conservative exposure parameters;

- Exposure Assessment - identifies the potential pathways of exposure, and estimates the concentrations of contaminants to which people may be exposed as well as the frequency and duration of these exposures;

- Toxicity Assessment - determines the toxic effects of the contaminants; and

- Risk Characterization - provides a quantitative assessment of the overall current and future risk to people from site contaminants based on the exposure and toxicity information.

The HHRA evaluated health effects which could result from exposure to soil, groundwater, surface water, and sediment contamination in the Phase I reuse area of VHFS. The HHRA evaluated potential risks to current workers who could be exposed to contaminants in surface soil, and to current trespassers who could be exposed to contamination in surface soil, surface water, and sediment. In addition, the HHRA evaluated potential risks to hypothetical future adult residents who could be exposed to contaminants in groundwater and surface soil and to hypothetical future child residents who could be exposed to contaminants in groundwater,



LEGEND:

- BUILDING
- PAVED ROAD
- FENCE
- STREAM
- 380 TOPOGRAPHIC CONTOUR (FT MSL)
- PERFORATED PIPE
- SITE BOUNDARY
- SI SURFACE SOIL SAMPLE LOCATION
- GROUNDWATER MONITORING WELL
- SI GROUNDWATER PUSH SAMPLE LOCATION
- SI DRY PROBE LOCATION
- RI SURFACE SOIL SAMPLE LOCATION
- IMPACTED SOIL AREA (APPROXIMATE)

N

0 50 100 150

SCALE IN FEET

FIGURE 6

SI AND RI SAMPLING LOCATIONS FOR AREE 21 SAND FILTER BEDS

AREE21

surface soil, surface water, and sediment. Potential risks to future excavation workers who could be exposed to contaminants in subsurface soil were also evaluated in the HHRA. Subsurface soil was only evaluated for excavation workers and not residents since residents would be unlikely to be exposed to subsurface soil. In addition, the concentrations of contaminants currently present in subsurface soil would not be representative of the concentrations that might be present if landscaping activities were to occur which would involve mixing of subsurface soils with surface soil, clean topsoil, and other soil amendments. Therefore, it would not be appropriate to evaluate risks to residents using available subsurface soil data.

Potential carcinogenic (cancer-related) effects and noncarcinogenic effects (including various impacts on different organ systems, such as lungs, liver, etc.) were evaluated in the HHRA. Carcinogenic effects are expressed as the probability that an individual will develop cancer from exposure to the contaminants from each AREE. The evaluation of noncarcinogenic effects is based on the hazard index (HI), which is the summation of the HQs for individual chemicals. The HQ is a comparison of chemical-specific chronic exposure doses with the corresponding protective doses derived from health criteria. The USEPA recommends that remedial actions may be warranted at sites where the carcinogenic risk to any person is greater than $1x\ 10^{-4}$ or the HI is greater than 1. A carcinogenic risk of $1x\ 10^{-4}$ means that there is a potential of one additional person in a population of 10,000 developing cancer from exposure to contaminants at an AREE if the AREE is not remediated. A HI greater than 1 indicates a potential for noncarcinogenic health effects if the AREE is not remediated.

The ERA also follows a four-step process:

- Problem Formulation - develops information that characterizes habitats and potentially exposed species and identifies contaminants of concern, exposure pathways, and receptors;
- Exposure Assessment - estimates exposure point concentrations for selected indicator species;
- Ecotoxicologic Effects Assessment - identifies concentrations or doses of contaminants that are protective of indicator species; and
- Risk Characterization - estimates potential adverse effects from exposure to contaminants based on exposure and toxicity information.

The ERA evaluated ecological effects which could result from exposure to surface soil, surface water, and sediment contamination in the Phase I reuse area of VHFS. The ERA evaluated potential adverse ecological effects to terrestrial plants and terrestrial invertebrates (represented by earthworms) exposed to contaminants in surface soil. In addition, potential adverse ecological effects to mammals (represented by shrews) and birds (represented by robins) through bioaccumulation in the food web and exposure to contaminants in surface soil were evaluated. Potential adverse ecological effects to aquatic life from exposure to contaminants in surface water and sediment were also evaluated in the ERA.

The evaluation of significant potential adverse ecological effects is based on the Environmental Effects Quotient (EEQ). The EEQ is the ratio of the estimated exposure concentrations/doses for the chemicals of potential concern and the toxicity reference values (TRVs) for the ecological receptors. If the EEQ is greater than 1, there is a potential for adverse ecological effects to occur. As the magnitude of the EEQ becomes greater than 1, the potential for adverse ecological effects becomes more significant.

The results of the BRA for the four AREEs are presented in the following paragraphs. A detailed presentation of the BRA can be found in the Phase I Reuse Area RI Report (USAEC, 1998), available in the Information Repository.

5.1 AREE 9-Vehicle Maintenance Area

The BRA determined that site-related contamination at AREE 9 does not pose an unacceptable human health risk or significant potential adverse ecological effects under either current industrial/commercial or potential future residential land-use conditions. 'in fact, since all the chemicals of potential concern in surface soil identified for AREE 9 in the HHRA are naturally-occurring metals that were statistically determined to be within background concentrations, the estimated upper-bound excess lifetime cancer risks and noncarcinogenic risks for site-related contaminants are less than $1xI0^{-6}$ and a HI of 0.1, respectively. However, risks associated with exposures to TPH could not be assessed in the BRA because this analytical parameter represents a mixture of chemical constituents. Since TPH measurements give no indication of the chemical constituents present or their respective concentrations, they cannot be used to predict risks. Although risks associated with TPH cannot be estimated, TPH contamination in subsurface soil beneath the Military Motor Pool neutralization pit is recommended for remediation because TPH concentrations exceed the Virginia TPH soil action level for USTs. The impacted area is approximately 3 ft x 3 ft, extending from the base of the neutralization pit at 4 ft bgs to bedrock at 8.5 ft bgs.

5.2 AREE 11 - Former Sewage Treatment Plant

The HHRA concluded that, under current industriallcornmercial land-use conditions, the risks to workers are unacceptable for exposure to see-related contaminants in surface soil at AREE 11. Under potential future residential land-use conditions, assuming that AREE 11 is not remediated, the risks to potential adult and child residents are also unacceptable for exposure to site-related contaminants in surface soil. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest estimated upper-bound excess lifetime cancer risk is for adult residents exposed to site-related contaminants in surface soil by dermal contact; this risk is $3x10^{-4}$ (i.e., three in 10,000 residents may develop cancer caused by contaminants in the AREE 11 surface soil). Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest noncarcinogenic risk is for child residents exposed to site-related contaminants in surface soil by incidental ingestion and dermal contact; the HI is estimated to be 10 for each of these routes of exposure. The organ systems impacted by noncarcinogenic contaminants at AREE 11 are the liver, kidney, blood, and gastrointestinal tract. The unacceptable human health risks result primarily from chlordane (a pesticide) and mercury. Although the concentrations of PAHs (specifically benzo[a]pyrene and dibenz[a,h]anthracene) at AREE 11 contribute to the unacceptable risks posed by incidental ingestion exposure to contaminants in surface soil, they do not drive the unacceptable risks. The highest estimated upper-bound excess lifetime cancer risk for a PAH is $7x\ 10^{-6}$ (seven in 1,000,000 people) for potential future child residents from incidental ingestion exposure to benzo(a)pyrene'.

The ERA determined that contaminants in surface soil at AREE 11 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from DDT (a pesticide), mercury, and silver. Mercury results in significant potential adverse ecological effects for terrestrial plants, terrestrial invertebrates. robins, and shrews, with the greatest potential adverse ecological effects occurring to robins (EEQ of 573). Silver and DDT result in significant potential, adverse ecological effects to terrestrial plants (EEQ of 60) and robins (EEQ of 51), respectively.

The most significant contamination is in the sludge pile area. which is recommended for remediation. The impacted area has dimensions of 45 ft in diameter and 0.5 ft deep, with contamination extending to 1.5 ft bgs In an isolated location near the center of the sludge pile area. The drying bed area, which has dimensions of 25 ft x 40 ft x 1.5 ft deep, is less contaminated. One isolated surface soil location in the drying bed area (sample location SS-11-004 as shown on Figure 4) is recommended for remediation.

5.3 AREE 19 - Pistol Range

The HHRA concluded that, under both current industrial/commercial and potential future residential land-use conditions, the risks to workers, trespassers, adult residents, and excavation workers are acceptable

for exposure to site-related contaminants in soil at AREE 19. However, the risks to potential future child residents are unacceptable for exposure to site-related contaminants in soil at AREE 19. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest estimated upper-bound excess lifetime cancer risk ($3X10^{-5}$) is for potential future child residents exposed to siterelated contaminants in surface soil by incidental ingestion, while the highest noncarcinogenic risk (HI = 2) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion. The organ system impacted by the noncarcinogenic contaminants at AREE 19 is the vascular system. The unacceptable human health risks result primarily from antimony and arsenic which are found in conjunction with the lead contamination.

The human health risks associated with exposure to lead in surface soil at AREE 19 were evaluated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model recommended by USEPA for evaluating lead exposures for young children in residential settings. The IEUBK Model calculates blood lead levels which result from exposures to lead which may then be compared to blood lead levels of toxicological significance for purposes of risk evaluation, The IEUBK Model run for AREE 19 predicted a geometric mean blood lead level of 9.6 µg/dL, with 42.7 percent of the population exceeding the level of concern (10µg/dL). The USEPA currently finds 5 percent of the population exceeding the level of concern as acceptable. Therefore, the IEUBK model results indicate that if AREE 19 was developed for residential use in the future, the lead concentrations in the surface soil may be a potential problem for young children.

The ERA determined that lead in surface soil at AREE 19 poses a significant potential adverse ecological effect for terrestrial plants (EEQ of 117).

The lead contamination in the impact berm surface soil is recommended for remediation. The approximate dimensions of the impacted area are 100 ft x 15 ft high x 2 ft deep.

5.4 AREE 211 - Sand Filter Beds

The HHRA concluded that, under both current industrial/commercial and potential future residential land-use conditions, the risks to workers, trespassers, residents, and excavation works are acceptable for exposure to site-related contaminants in surface soil at AREE 21. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest estimated upper-bound excess lifetime cancer risk ($9x10^{-6}$) is for adult residents exposed to site-related contaminants in surface soil by dermal absorption, and the highest noncarcinogenic risk (HI = 0.2) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion.

The ERA determined that contaminants in surface soil at AREE 21 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from 2,3,7,8-TCDF (a furan). 2,3,7,8-TCDF results in significant potential adverse ecological effects for robins (EEQ of 38).

The primary-compound of concern, 2,3,7,8-TCDF, was detected in the absorption field area but not in the Sand Filter Beds themselves. Surface soil along the absorption field is recommended for possible remediaton pending establishment of soil cleanup levels. The approximate dimensions of the impacted soil area are 375 ft x 3 ft x 3 ft deep.

6.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. The remedial action objective for the four AREEs is to minimize the potential for contaminated soil to pose unacceptable risks to human or ecological receptors.

7.0 CLEANUP LEVELS ESTABLISHED FOR THE SELECTED ALTERNATIVE

USEPA has established soil cleanup levels for the contaminants that contribute to the unacceptable risk determination at each of the four AREEs. The soil cleanup levels are presented in Table 1. The soil cleanup level for AREE 9 is based on the Virginia TPH soil action level for USTs of 100 ppm. In general. USEPA established the soil cleanup levels for AREE 11 based on either a 1×10^{-6} (one in 1,000,000 people) excess lifetime cancer risk for carcinogens' or a hazard quotient of 1 for noncarcinogens, whichever was more stringent for the potential future residential use scenario. However, the soil cleanup levels for DDT, mercury, and silver at AREE 11 are based on concentrations which are protective of ecological receptors. The soil cleanup level for AREE 19 is based on a level recommended for the protection of ecological receptors by the U.S. Fish and Wildlife Service. The soil cleanup level for AREE 21 is based on concentrations which are protective of ecological receptors. The cleanup level for 2,3,7,8-TCDF (1.12×10^{-4} ppm) is higher than the maximum detected concentration at AREE 21 of 8.71×10^{-6} ppm; therefore, no action is required at AREE 21.

8.0 SUMMARY OF REMEDIAL ALTERNATIVES

Two remedial alternatives were evaluated to address soil contamination at AREEs 9, 11, and 19. As discussed above, no action is required for AREE 21 because the cleanup level is higher than the maximum detected contaminant concentration. The range of remedial alternatives considered was limited by the nature and extent of the contamination. Since the amount of soil requiring remediation is relatively small (less than 300 cubic yards combined), it was not practical to consider active treatment or containment options in terms of cost effectiveness and implementabilty. The following remedial alternatives were evaluated:

- Alternative 1 - No Action; and
- Alternative 2 - Soil Removal.

8.1 Alternative 1 - No Action

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), require that a No Acton alternative be considered as a baseline for comparison to other alternatives. No action would be taken to address site contamination under this alternative. In accordance with Section 121 of CERCA, each AREE would be reviewed at least once every five years to re-evaluate site conditions and to determine the need for remedial action to protect human health and the environment.

8.2 Alternative 2 - Soil Removal

Under this alternative, all contaminated soil exceeding the established cleanup levels would be excavated, transported off site by truck, and disposed using a combination of permitted off-site hazardous waste, construction debris, and/or municipal landfills, as appropriate based on analytical results. Less than 300 cubic yards of impacted soil would be excavated as part of this alternative, followed by confirmation sampling to assure adequate removal of all soil exceeding the cleanup levels. Upon completion of the soil excavation, disturbed areas would be backfilled, regraded, and either vegetatively stabilized or paved (AREE 9).The five year review does not apply to this alternative because hazardous substances above risk-based cleanup levels would not remain on site.

The soil cleanup levels for AREE 11 presented in the Proposed Plan (Attachment 1) were based on a $1X10^{-5}$ (one in 100,000 people) excess lifetime cancer risk for carcinogens. The basis for the soil cleanup levels was made more stringent per the request of USEPA.

Table 1
Cleanup Levels Established for Soils at the Four AREEs

Constituents	Cleanup Levels (ppm)
AREE 9 - VEHICLE MAINTENANCE AREA	
Total Petroleum Hydrocarbons	100 (a)
AREE 11 -FORMER SEWAGE TREATMENT PLANT	
Aldrin (Human Health risk) (b)	0.038 (c)
Cadmium (Human Health risk) (b)	39 (c)
Chlordane (Human Health risk)	0.49 (c)
alpha-Chlordane (Human Health risk) (b)	0.49 (c)
gamma-Chlordane (Human Health risk) (b)	0.49 (c)
DDT (Ecological risk)	0.26 (d)
Mercury (Human Health & Ecological risk)	0.29 (d)
Silver (Ecological risk)	20 (d)
AREE 19 - PISTOL RANGE	
Lead (Human Health & Ecological risk)	200 (e)
AREE 21 - SAND FILTER BEDS	
2,3,7,8-TCDF (Ecological risk)	1.12×10^{-4} (d)

DDT, - Total concentration of DDD, DDE, and DDT

(a) Virginia total petroleum hydrocarbon soil action level for underground storage tanks.

(b) These compounds contribute to but do not drive unacceptable risk.

(c) Based on either a 1×10^{-6} upper-bound excess lifetime cancer risk for carcinogens or a hazard quotient of 1 for noncarcinogens, whichever is more stringent, for the potential future residential use scenario.

(d) Based on a concentration which is protective of ecological receptors (EEQ = 10).

(e) Cleanup level for lead in surface soil recommended by the U.S. Fish and Wildlife Service for the protection of ecological receptors.

9.0 EVALUATION OF ALTERNATIVES

CERLCA requires a comparison of the alternatives using nine evaluation criteria: overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements (ARARs); long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; cost; and regulator and community acceptance. The first two criteria are considered by USEPA to be threshold criteria which must be met by each alternative. The nine evaluation criteria are described below.

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how ' risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provides grounds for invoking a waiver.

- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health over time, once cleanup goals have been met.

- Reduction of toxicitv. mobilitv. or volume through treatment is the anticipated performance of the treatment technologies a remedy may employ.

- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and operation and maintenance costs, and net present worth costs.

- Regulator acceptance indicates whether, based on their review of the RI and Proposed Plan, the regulators (the Virginia Department of Environmental Quality [VDEQ] and USEPA) concur, oppose, or have no comment on the selected alternative.

- Community acceptance is assessed in the Responsiveness Summary which summarizes the public comments received on the RI and the Proposed Plan.

The comparative analysis of the alternatives was conducted based upon these evaluation criteria, and is described below.

9.1 Overall Protection of Human Health and the Environment

The no action alternative (Alternative 1) is not protective of human health or the environment because the risks to potential future residents and the potential adverse effects to ecological receptors remain unchanged, which is unacceptable. Therefore, the no action alternative was eliminated from further consideration and will not be discussed further.

Alternative 2 provides adequate protection of human health and the environment by removing contaminated soil, thereby eliminating the potential for exposure.

9.2 Compliance with ARARs

Alternative 2 has been designed to achieve or comply with ARARs. This alternative will satisfy the established cleanup levels since all soil that is contaminated above applicable cleanup levels will be removed. In addition, the removal and disposition of contaminated soil during implementation of Alternative 2 would be done in accordance with federal and Virginia solid and hazardous waste regulations. During soil excavation, the Regulations of the Virginia Air Pollution Control Board may apply. Ambient 'air conditions would be monitored during excavation activities to assure acceptable air quality. As necessary based on the ambient air monitoring, water sprays would be used to keep dust levels down.

9.3 Long-term Effectiveness and Permanence

Alternative 2 would provide for the permanent removal of contaminated soil to a permitted off-site location designed to prevent contaminant migration and exposures to human and ecological receptors.

9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 provides reduction of contamination at the AREEs by removing contaminated soil. The toxicity and volume of the contaminated soil would not be affected by this alternative; however, the mobility of the contaminants would be reduced because the off-site disposal facilities used would be designed to prevent contaminant migration.

Because treatment of the contaminated soil at the AREEs was not found to be practicable due to the small volume of impacted soil, Alternative 2 does not satisfy the statutory preference for treatment as a principal element of the remedy.

9.5 Short-term Effectiveness

Alternative 2 is considered to be effective in the short term because the volume of soil to be excavated is relatively small and would result in limited negative impacts to human health or the environment. Dust exposure to workers and adjacent residents would be controlled during excavation activities by water sprays as needed. Prior to excavation operations, temporary erosion control structures would be installed to prevent entry of storm water into the soil excavation areas and prevent erosion and movement of soil from contaminated areas. Although truck traffic would be increased during implementation of Alternative 2, the implementation period (approximately one month) is short and the number of trucks per day would be less than 20.

9.6 Implementability

Alternative 2 is considered readily implementable. Licensed transporters and permitted disposal facilities are currently available.

9.7 Cost

The cost to implement Alternative 2 is estimated at $360,000.

9.8 Regulator Acceptance

VDEQ and USEPA concur with the selected remedy.

9.9 Community Acceptance

A public meeting on the Proposed Plan was held on September 18, 1997, in Warrenton, Virginia. Comments received during the public meeting and the public comment period are referenced in the Responsiveness Summary (Section 12 of this DD).

10.0 SELECTED REMEDY AND STATUTORY DETERMINATIONS

10.1 Selected Remedy

Following review and consideration of the information in the Information Repository, requirements of CERCLA and the NCP, and the review of public comments on the Proposed Plan, the U.S, Army, in coordination with VDEQ and USEPA, has selected Alternative 2, Soil -Removal, as the remedy for the contaminated soil at AREEs 9, 11, and 19. No action is the selected remedy for the soil at AREE 21 because the cleanup level is higher, than the maximum detected contaminant concentration.

Under the selected remedy for AREEs 9, 11, and 19, all contaminated soil exceeding the established cleanup levels would be excavated, transported off site by truck, and disposed using a combination of permitted off-site hazardous waste, construction debris, and/or municipal landfills, as appropriate based on analytical results. Less than 300 cubic yards of impacted soil would be excavated as part of this alternative, followed by confirmation sampling to assure adequate removal of all sod exceeding the cleanup levels (refer to Table 1). Upon completion of the soil excavation, disturbed areas would be backfilled, regraded, and either vegetatively stabilized or paved (AREE 9).

The estimated cost to implement this alternative is $360,000, and the on-site activities would require approximately one month to complete.

10.2 Statutory Determinations

Under CERCLA Section 121, selected remedies must be protective of human health and the environment must comply with ARARs (unless a statutory waiver is justified), must be cost-effective, and must utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition. CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous waste as their principal element. The following sections discuss the remedy in light of these statutory requirements.

10.2.1 Protection of Human Health and the Environment

The selected remedy (i.e., no action for AREE 21; and remedial action for AREEs 9, 11, and 19) would protect human health and the environment All contaminated soil exceeding the established cleanup levels will be removed and disposed of in permitted, off-site facilities. The cleanup levels listed in Table 1 were developed to be protective of human health and the environment.

Short-term risks would be present as a result of dust exposure to workers and adjacent residents, soil erosion and sedimentation during excavation activities, and transport of contaminated soil off site. These risks would be acceptable as a result of control measures which would be implemented during the remedial action. These control measures include use of water sprays during excavation operations to control dust, and use of silt fences and other erosion control techniques to control erosion and soil movement from contaminated areas. The increase in truck traffic would be minimal, with the addition of less than 20 trucks per day over the course of approximately one month.

10.2.2 Compliance with ARARs

The selected remedy will be in full compliance with ARARs:

- 9 Virginia Administrative Code (VAC) 20-80-10 et seg : Virginia Solid Waste Management Regulations - the disposal of any soil, debris, sludge or any other solid waste must be done in compliance with the regulations;

- 9 VAC 20-60-10 et seg : Virginia Hazardous Waste Management Regulations - the disposal of any hazardous waste must be done in compliance with the regulations;

- 4 VAC 50-30-10, et seg : Virginia Erosion and Sedimentation Control Regulations - an erosion and sedimentation control plan that complies with the minimum design and implementation standards of the regulations will be prepared before engaging in any land disturbing activity;

- 9 VAC 5-10-10 through 9 VAC 5-80-350: Regulations of the Virginia Air Pollution Control Board ambient air monitoring will be used to determine the need for water sprays to control dust generation in order to comply with ambient air quality standards for particulate matter.

10.2.3 Cost-Effectiveness

The selected remedy affords overall effectiveness proportional to its costs. All contaminated soil exceeding the established cleanup levels will be removed from AREEs 9, 11, and 19. No action is required for AREE 21 based on the established soil cleanup level. The entire remedy will be achieved for approximately $360,000.

10.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions to the maximum extent practicable while providing the best balance among the other evaluation criteria. It achieves the best balance of tradeoffs with respect to the primary balancing criteria of long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost; while also considering regulator and community acceptance.

The selected remedy provides a high degree of long-term effectiveness and permanence as the removal and off-site disposal of the contaminated soil would be permanent and irreversible. The variety of contaminants present in the soil at AREEs 9, 11, and 19 and the relatively small volume of contaminated soil cause on-site treatment technologies to be impracticable and not cost-effective. The selected remedy is easily implementable, with a relatively short time frame needed for design development. There is minimal risk to the community during the implementation of the selected remedy, and the slight risks to the environment can be reduced by implementing standard procedures, such as erosion and sedimentation controls.

10.2.5 Preference for Treatment as a Principal Element

Because treatment of the principal threat at AREEs 9, 11, and 19 was not found to the practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

11.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Proposed Plan for AREEs 9, 11, 19, and 21 was released to the public on September 11, 1997 (see Attachment 1). This document was made available for public review in the Information Repository at the following location:

Fauquier County Library
Warrenton Branch - Reference Section
111 Winchester Street, Warrenton, VA
(540) 347-8750
Monday - Wednesday: 10:00 a.m. to 9:00 p.m.
Thursday - Saturday: 9:00 a.m. to 5:00 p.m.
Sunday: 1:00 p.m. to 5:00 p.m.

The notice of availability of the Proposed Plan (see Attachment 3) was published in The Fauguier Citizen, the Fauquier Times-Democrat and the Manassas Journal Messenger during the week Of September 8,1997. A public comment period was held from September 11, 1997 through October 10, 1997. In addition, a public meeting was held on September 18,1997, to present the Proposed Plan for AREEs 9, 11. 19, and 21 and to answer questions and receive public comments. The public meeting minutes have been transcribed, and a copy of the transcript is available to the public at the aforementioned location. A Responsiveness Summary, included as part of this Decision Document (DD), has been prepared to respond to the significant comments, criticisms, and new relevant information received during the comment period. Upon signing the DD, the U.S. Army will publish a notice of availability of this DD in The Fauguier Citizen, the Fauguier Times Democrat, and the Manassas Journal Messenger, and place the DD in the Information Repository.

12.0 RESPONSIVENESS SUMMARY

The purpose of this Responsiveness Summary is to provide the public with a summary of citizen comments, concerns, and questions about AREEs 9, 11, 19, and 21. A public meeting was held on September 18, 1997, to present the Proposed Plan and to answer questions and receive comments. At the public meeting, several citizens had questions regarding the Proposed Plan. No written public comments were received during the September 11, 1997, through October 10, 1997, comment period.

The Responsiveness Summary Is divided into the following sections:

- Selected newspaper notices announcing dates of the public comment period and location and time of the public meeting;
- Comments raised during the public meeting on September 18, 1997;
- Public meeting attendance roster; and
- Restoration Advisory Board Members.

All comments and concerns summarized In this document have been considered by the U.S. Army in making a decision regarding the selected alternative.

12.1 Selected Newspaper Notices

A public notice announcing the availability of the Proposed Plan and the public meeting was published in The Fauguier Citizen, the Fauguier Times-Democrat and the Manassas Journal Messenger the week of September 8, 1997. This public notice is provided in Attachment 3.

12.2 Comments Raised During the Public Meeting on September 18,1997

Several citizens raised questions during the public meeting. The citizens' questions and the U. S. Army's responses are presented below:

CONCERNED CITIZEN: Is there any risk that the $360,000 of required funding may not being available?

ARMY RESPONSE: No, the project is fully funded.

CONCERNED CITIZEN: For AREE 21, how can the cleanup level be higher than the maximum detected concentration? Are there still ecological risks to wildlife?

ARMY RESPONSE: Based on the BRA, it was determined that there was unacceptable ecological risks posed by the contamination at AREE 21. However, the BRA uses conservative assumptions such as the assumption that the entire foraging ground for robins is contaminated at the maximum detected contaminant concentration present at AREE 21. This is an unrealistic assumption because AREE 21 is only a thin strip of land, which represents a very small percentage of a robin's foraging ground. When the size of AREE 21 is considered in the calculation of a cleanup level, a cleanup level greater than the maximum detected contaminant concentration at AREE 21 is calculated. The BRA uses conservative assumptions so that sites that may need to be remediated are not overlooked; while the cleanup level is a level that brings the site into acceptable risk limits under realistic conditions. The need for remediation at AREE 21 was ultimately based on a risk management decision using the more realistic risk-based cleanup level. Since a robin would not just consume earthworms from the small strip of land contaminated at AREE 21, the risk posed by AREE 21 is acceptable..

CONCERNED CITIZEN: Once these sites are cleaned up, will sampling be conducted to ensure that the sites are safe?

ARMY RESPONSE: Yes, confirmation sampling will be conducted to ensure that the cleanup levels are achieved, and then a post-remediation risk assessment will be conducted to ensure that the risk posed by the residual contamination is acceptable.

CONCERNED CITIZEN: Would any restrictions be placed on AREE 21 that it not be disturbed? AREE 21 is located in the area currently designated for the golf course. Could the soil in that area be moved around to accommodate desired terrain changes?

ARMY RESPONSE: There would be no restrictions on the future use of AREE 21.

CONCERNED CITIZEN: What is the name of the facility and its location where the contaminated soil will be disposed? Will it be a hazardous waste facility? Will it be hauled to the local landfill?

ARMY RESPONSE: The disposal facility has not been determined yet, but acceptably permitted facilities will be used. If warranted based on waste characterization sampling, a permitted hazardous waste disposal facility will be used. Given the levels of contamination at these AREEs, the excavated soil even if non-hazardous will probably not be acceptable for disposal at the local landfill; however, that determination will be made once the waste characterization sampling results are received and reviewed. The waste will have to satisfy the selected landfill's permit requirements before it can be disposed therein.

12.3 Public Meeting Attendance Roster

The public meeting was held on September 18,1997, at the Warrenton Middle School. The members of the community that attended the public meeting included Owen Bludau, Debra Reedy, and Dean Eckelberry.

12.4 Restoration Advisory Board Members

1. Debra Reedy, Community Co-Chair
2. Richard Reisch, U.S. Army Co-Chair
3. Dean Eckelberry
4, John Mayhugh
5. Jeff Lippincott
6. Owen Bludau

7. Tim Tarr
8. Norris Goff
9. Erich Meding
10. Kevin Bell
11. Mark Stevens
12. Nancy Inger
13. Joanne Smith
14. Henry Ross
15. Steve Mihalko
16. Robert Stroud
17. Steve Maddox
18. William Downey
19. Gina Tyo
20. Joe Phelan
21. Gary Clare
22. Mike Molloy
23. Denny Adams
24. Joe Wiltse
25. Bob Root
26. Georgia Herbert
27. Robert Kube
28. Kimberly Davis
29. George Rosenberger
30. Adrienne Garreau
31. Susan Dove
32. James Tucker
33. John Williams

13.0 REFERENCES

U.S. Army Environmental Center (USAEC). 1996. Site Inspection Report with Supplemental Hydrogeologic Investigation. Vint Hill Farms Station. Warrenton, Virginia. Final Document. Prepared by Science Applications International Corporation, McLean, Virginia. June, 1996.

U.S. Army Environmental Center (USAEC). 1998. Remedial Investigation Report Vint Hill Farms Station Phase I Reuse Area Remedial Investigation/Feasibility Study. Final Document, Prepared by ICF Kaiser
Engineers, Inc. Edgewood, Maryland. April, 1998.

ATTACHMENT 1

Proposed Plan

Proposed Plan

AREEs 9, 11, 19, and 21
Vint Hill Farms Station, Virginia

September 1997

INTRODUCTION

The U.S. Army has identified a preferred alternative to address contaminated soil at selected Areas Requiring Environmental Evaluation (AREEs) located on Vint Hill Farms Station (VHFS). The major characteristics of the U.S. Army's preferred alternative (Alternative 2 in this Proposed Plan) include excavation of contaminated soil and off-site disposal at a permitted facility.

This Proposed Plan is based on site-related documents contained ' in the VHFS Information Repository. The Information Repository can provide you with important information about the site and the AREEs. The Information Repository is located at:

Fauquier County Library
Warrenton Branch - Reference Section
11 Winchester Street, Warrenton, VA
(540) 347-8750
Monday - Wednesday: 10:00 a.m. to 9:00 p.m.
Thursday - Saturday: 9:00 a.m. to 5:00 p.m.
Sunday: 1:00 p.m. to 5:00 p.m.

The U.S. Army needs your comments and suggestions. The U.S. Army, the U.S. Environmental Protection Agency (USEPA) Region III, and the Virginia Department of Environmental Quality (VDEQ) encourage the public to review and comment on both of the alternatives presented in the Proposed Plan. The public comment period begins on September 11, 1997, and closes on October 10, 1997. Please send your comments, postmarked no later than October 10, 1997, to:

Kevin Bell, Public Affairs Officer
Public Affairs Office (Bldg. 101)
Vint Hill Farms Station
Warrenton, VA 20187-5010

In addition, you are invited to a public meeting regarding the investigation and cleanup of contamination at the AREEs. Representatives from the U.S. Army will report on cleanup alternatives considered and the U.S. Army's preferred alternative. The meeting is scheduled for:

Thursday, September 18, 1997 at 7:00 p.m.
Warrenton Middle School Auditorium
244 Waterloo Street, Warrenton, VA

The remedy described in this Proposed Plan is the U.S. Army's preferred alternative for the selected AREEs. The U.S. Army may modify the preferred alternative or select another remedial alternative if public comments or additional data indicate that such a change will result in a more appropriate remedial action. The U.S. Army, in consultation with USEPA. and VDEQ, will make a remedy selection for the AREEs in a Decision Document after the public comment period has ended and the comments and information submitted during that time have been reviewed and considered.

The U.S. Army is issuing this Proposed Plan as part of its public participation responsibilities under Sections 113(k) and 117(a) of the Comprehensive Response, Compensation, and Liability Act (CERCLA) as amended, commonly known as the "Superfund Program", and the National Environmental Policy Act of 1969 (NEPA).

SITE BACKGROUND

VHFS is part of the U.S. Army Communications - Electronics Command (CECOM) and primarily functions as an Army installation engaged in communications intelligence. VHFS is located approximately 40 miles southwest of Washington, D.C., in Fauquier County, Virginia, as shown on Figure 1. The installation occupies approximately 701 acres of land near the town of Warrenton, Virginia. Approximately 150 acres of the installation are improved grounds in the southern portion of the property used for industrial operations, administration buildings, and residential housing. Approximately 94 acres on the eastern portion of the property are mature hardwood forest, and the majority of the remaining 457 unimproved and semi-improved acres in the northern portion of the property are used for stationary and mobile antenna operation sites. The facility was designated for closure in March, -1993, under the Base Realignment and Closure (BRA) Act.

Pursuant to the decision to close the installation, an Enhanced Preliminary Assessment (ENPA) and a Community Environmental Response Facilitation Act (CERFA) investigation of VHFS were conducted by Science Applications International Corporation (SAIC) to assess the environmental condition of the installation. The ENPA and CERFA investigations were completed in April and May, 1994, respectively. The ENPA identified 42 AREEs from the review of installation records, aerial photographs, installation personnel irterviews, federal and state regulatory records, and visual inspection. Of these 42 AREEs, 27 were recommended for further investigation.

These 27 AREEs were investigated from September, 1994, to June, 1995, as part of the Site Inspection (SI) conducted by SAIC. The objective of the SI was to determine the presence or absence of contamination and the chemical nature of any detected contamination. The final SI Report, which was completed in June, 1996, identified 24 AREEs which required further investigation. AREEs that were determined under the Sl to warrant further investigation and are located in the Phase I reuse area (shown on Figure 2) were investigated between April and June, 1996, as part of the Phase I reuse area Remedial Investigation (RI conducted by ICF Kaiser Engineers, Inc. (ICF KE). The purpose of the RI was to evaluate: 1) the nature and extent of contamination; and 2) the level of risk posed to human health and the environment. The draft RI Report for the Phase I reuse area was completed in April, 1997, and is currently undergoing regulatory review.

Four AREEs were identified in the RI as having soil contamination which poses unacceptable human health risks and/or significant adverse ecological effects:

- AREE 9 - Vehicle Maintenance Area;
- AREE 11 - Former Sewage Treatment Plant;
- AREE 19 - Pistol Range; and
- AREE 21 - Sand Filter Beds.

The locations of these AREEs are shown on Figure 2.

RESULTS OF THE REMEDIAL INVESTIGATION

The RI for these four AREEs was conducted to evaluate the nature and extent of contamination associated with past site activities. Environmental samples collected and analyzed during the RI were used in conjunction with the results from the Sl to assess the condition of each of the AREEs. The environmental media investigated included surface soils (0 to 2 feet below ground surface), subsurface soils (2 feet to

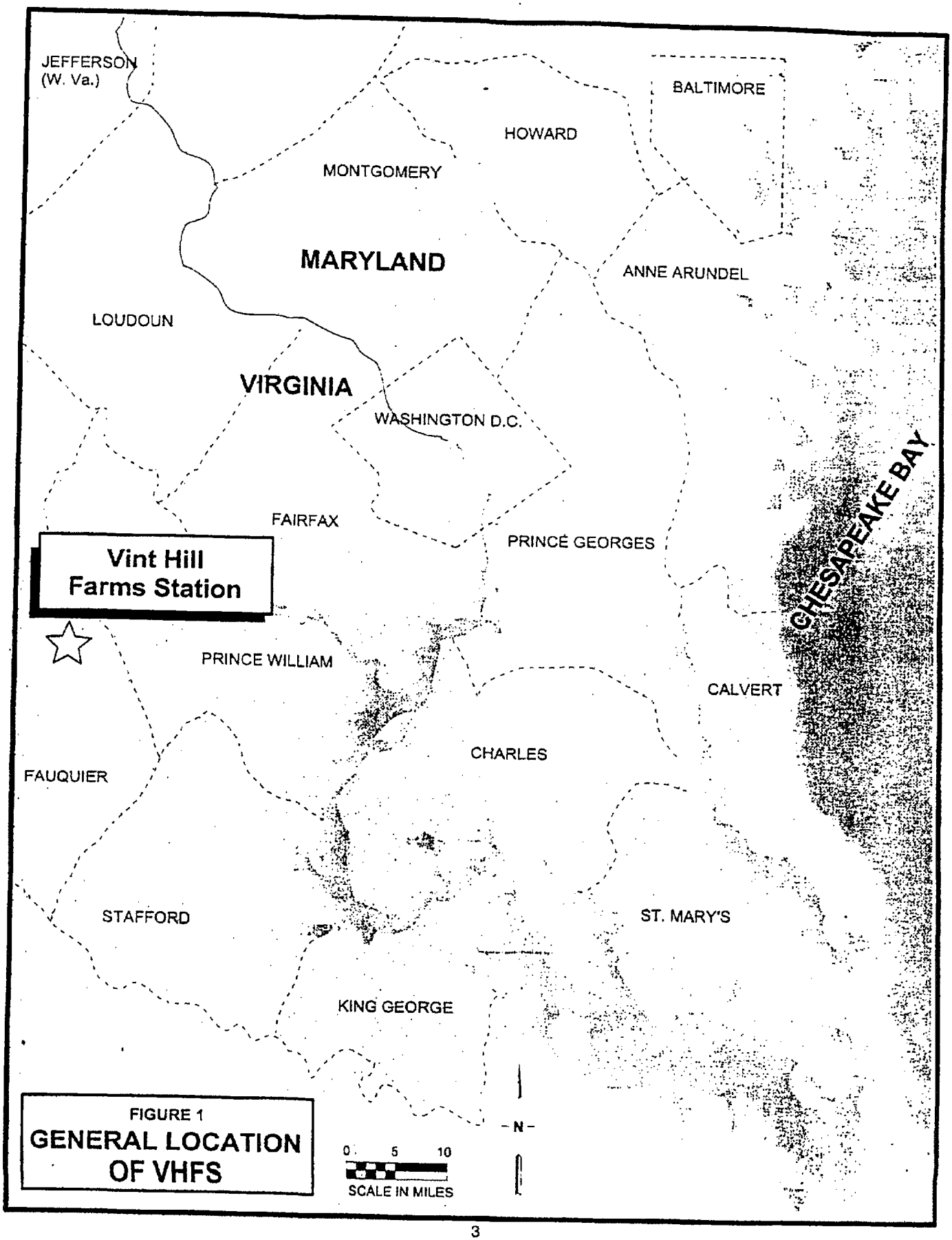


FIGURE 1
GENERAL LOCATION OF VHFS

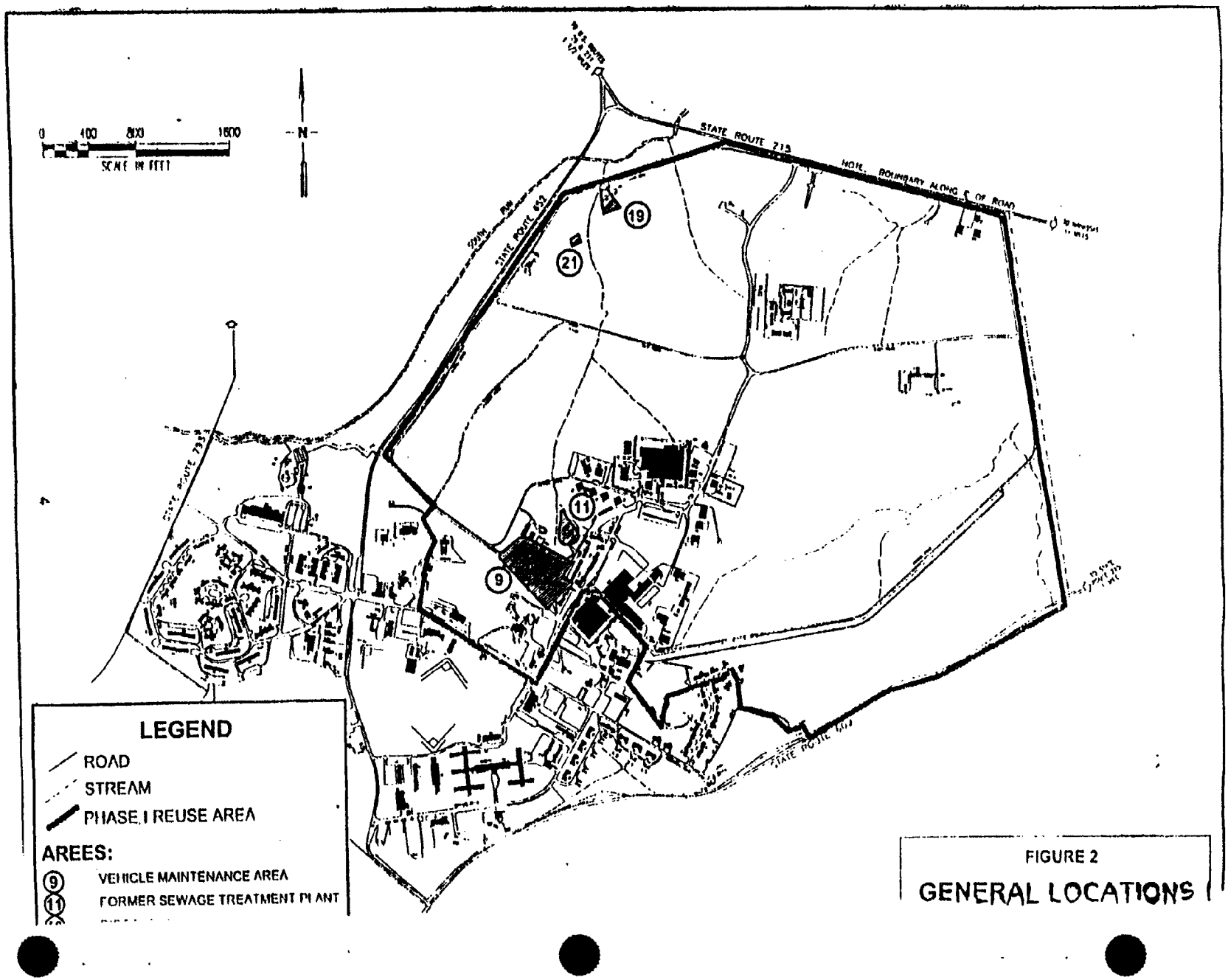


FIGURE 2

GENERAL LOCATIONS

approximately 12 feet below ground surface), surface water, sediment, and groundwater. Analytical results were compared to background concentrations and regulatory screening levels to determine if environmental media had been adversely impacted by site activities, A brief description of each of the four AREEs and the significant findings of the RI and S1 are presented in the following paragraphs. A detailed presentation of the samples collected and the analytical results can be found in the draft RI Report, now available in the Information Repository at the Fauquier County Library.

AREE 9 - Vehicle Maintenance Area

AREE 9 is an area used for general maintenance of military, government, and private vehicles. Small spills of oil, grease, gasoline, and cleaning solvents have been reported on the asphalt areas within the AREE. Neutralization pits (approximately 3 ft x 3 ft X 4 ft deep) which receive wastewater from the sinks within the Civilian Motor Pool (Building 288) and the Military Motor Pool (Building 290) are located outside each building. The Civilian Motor Pool neutralization pit has a cement bottom, and the Military Motor Pool neutralization pit has an earthen bottom.

Surface soil, subsurface soil, sediment, surface water, and groundwater samples were collected at AREE 9 as shown on Figure 3. Total Petroleum Hydrocarbon (TPH) contamination, exceeding the Virginia TPH soil action level for underground storage tanks (USTs) of 100 parts per million (ppm), is present in subsurface soil beneath the Military Motor Pool neutralization pit (which has an earthen bottom). The highest TPH concentration (8,440 ppm) was detected at the base of the neutralization pit. The TPH contamination extends to bedrock at approximately 8.5 feet below ground surface, and decreases with depth.

AREE 11 - Former Sewage Treatment Plant

AREE 11 is the site of the former Sewage Treatment Plant (STP). The former STP was active from 1948 to 1981, and was used to treat wastewaters from VHFS activities, including industrial wastewaters from photographic, painting, laboratory, vehicle washing, and metal etching operations. The sludges from the treatment process were dried on drying beds and stored in sludge plies. The locations of these areas are shown on Figure 4.

Surface and subsurface soil samples were collected in the vicinity of the drying beds and sludge piles. Groundwater samples were collected downgradient of these areas. Polynuclear aromatic hydrocarbon (PAH) contamination, exceeding residential soil Risk-based Concentrations (RBCs) established by USEPA Region III for screening of analytical results, is present in the surface and subsurface soil in the drying bed area and the sludge pile area. Pesticide contamination, exceeding residential soil RBCs, is present in the surface and subsurface soil in the sludge pile area. Mercury contamination, exceeding the residential soil RBC, is present in the surface soil in the sludge pile area.

AREE 19 - Pistol Range

AREE 19, the Pistol , Range, has been in use since 1961 for limited target practice using .22-32-38, and .45 caliber handguns. The firing fan is directed southward toward a horseshoe-shaped impact berm, which captures the bullets. The layout of the Pistol Range shown on Figure 5. Spent ammunition was not recovered, but shell casings were collected and returned to the fixed ammunition magazine.

Surface soil, subsurface soil, and sediment samples were collected from the impact berm and surrounding area. Lead contamination, exceeding USEPA's screening level of 400 ppm for lead in soil for residential use, is confined to the surface soil of the impact berm. The highest concentrations of lead (up to 5,850 ppm) were detected within the first six inches of the impact berm. Lead concentrations in the samples collected deeper into the impact berm were generally one to two orders of magnitude lower than those at the surface and were all less than 400 ppm.

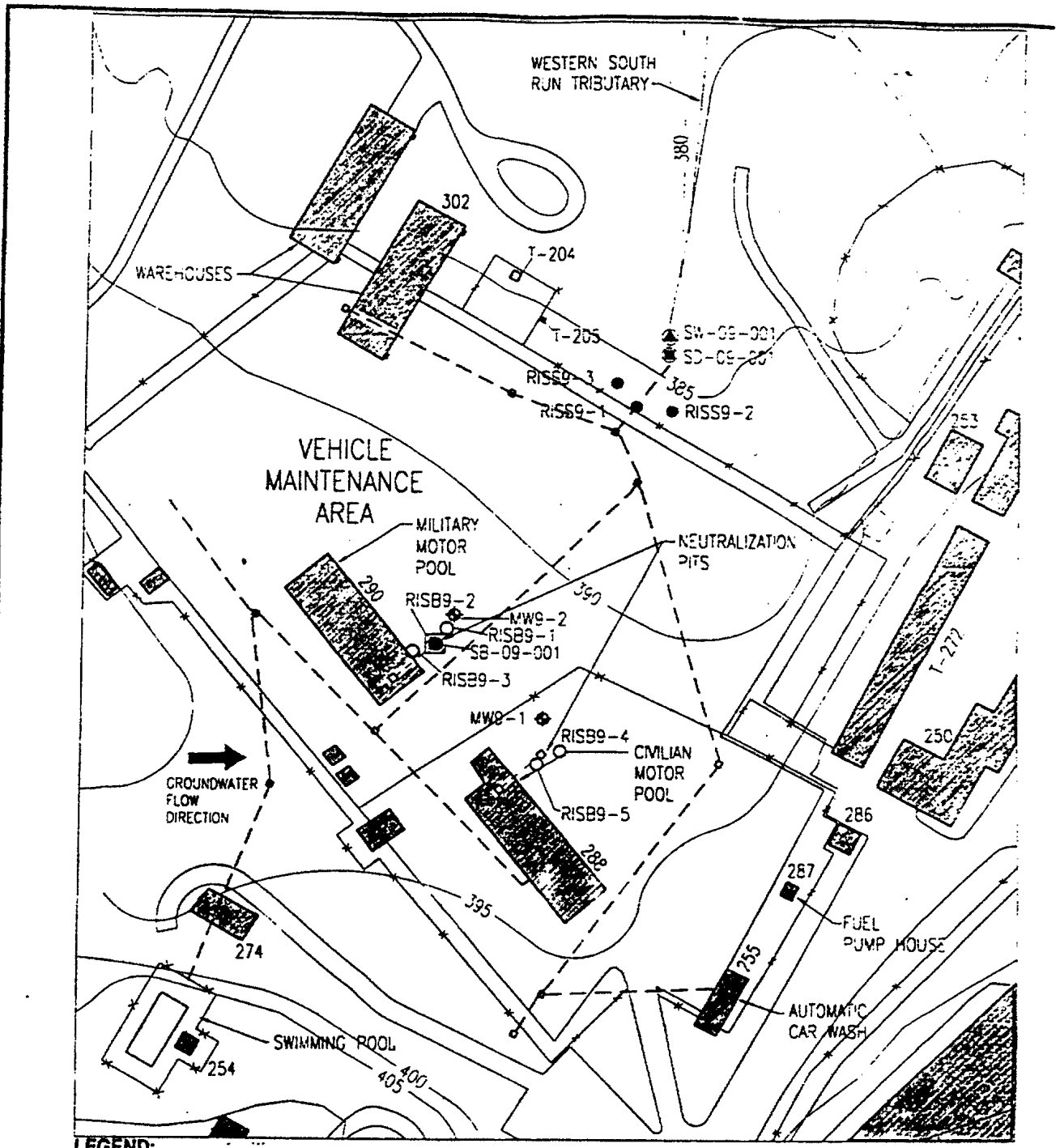
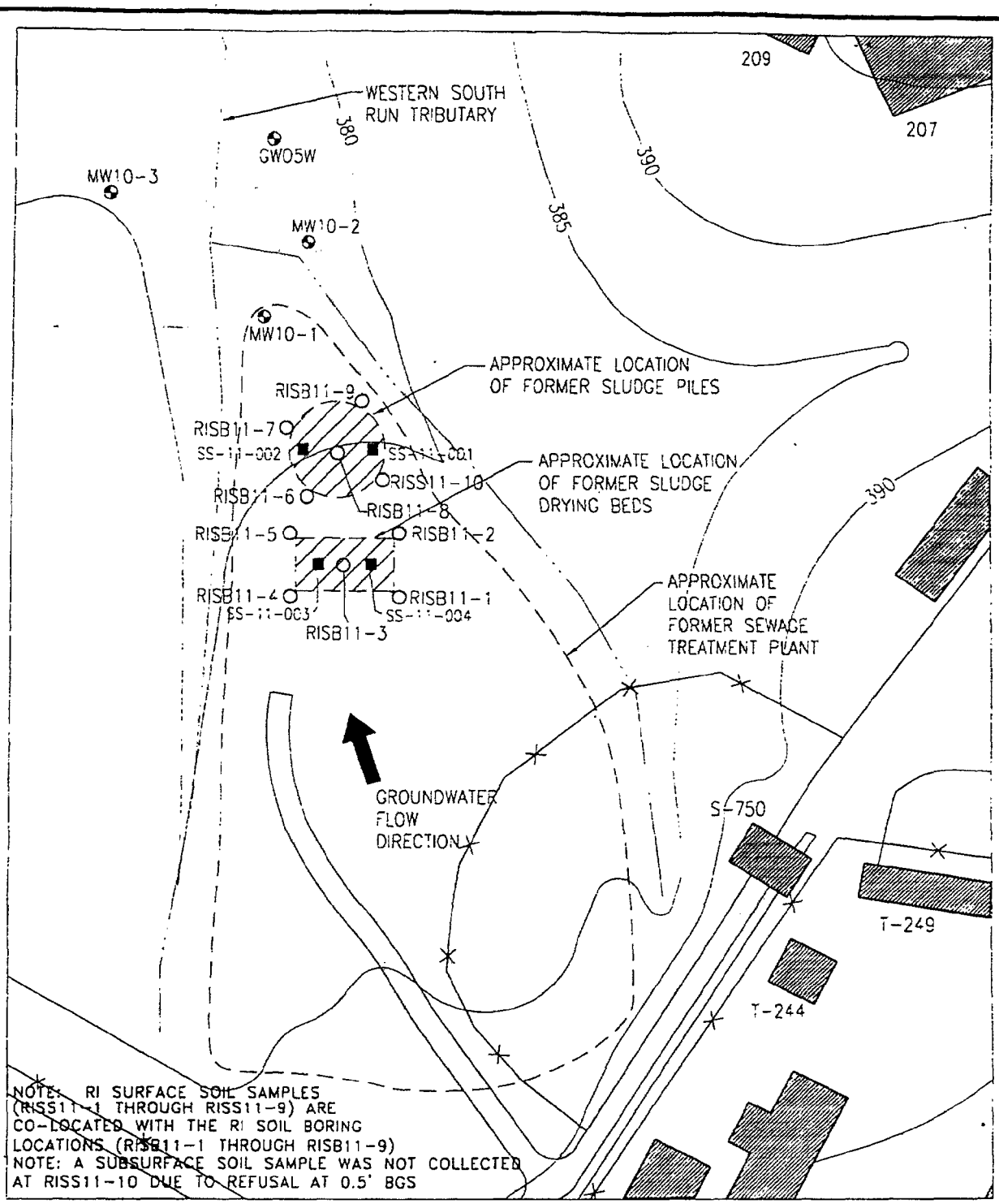


FIGURE 3
SI AND RI SAMPLING LOCATIONS FOR AREE 9 VEHICLE MAINTENANCE AREA



LEGEND:

- BUILDING
- FENCE
- ROAD
- STREAM
- 380 TOPOGRAPHIC CONTOUR (FT MSL)
- SI SURFACE SOIL SAMPLE LOCATION
- RI SOIL BORING LOCATION
- GROUNDWATER MONITORING WELL
- IMPACTED SOIL AREA (APPROXIMATE)

N

0 30 60

SCALE IN FEET

FIGURE 4

SI AND RI SAMPLING LOCATIONS FOR AREE 11 - FORMER SEWAGE TREATMENT PLANT

AREE11

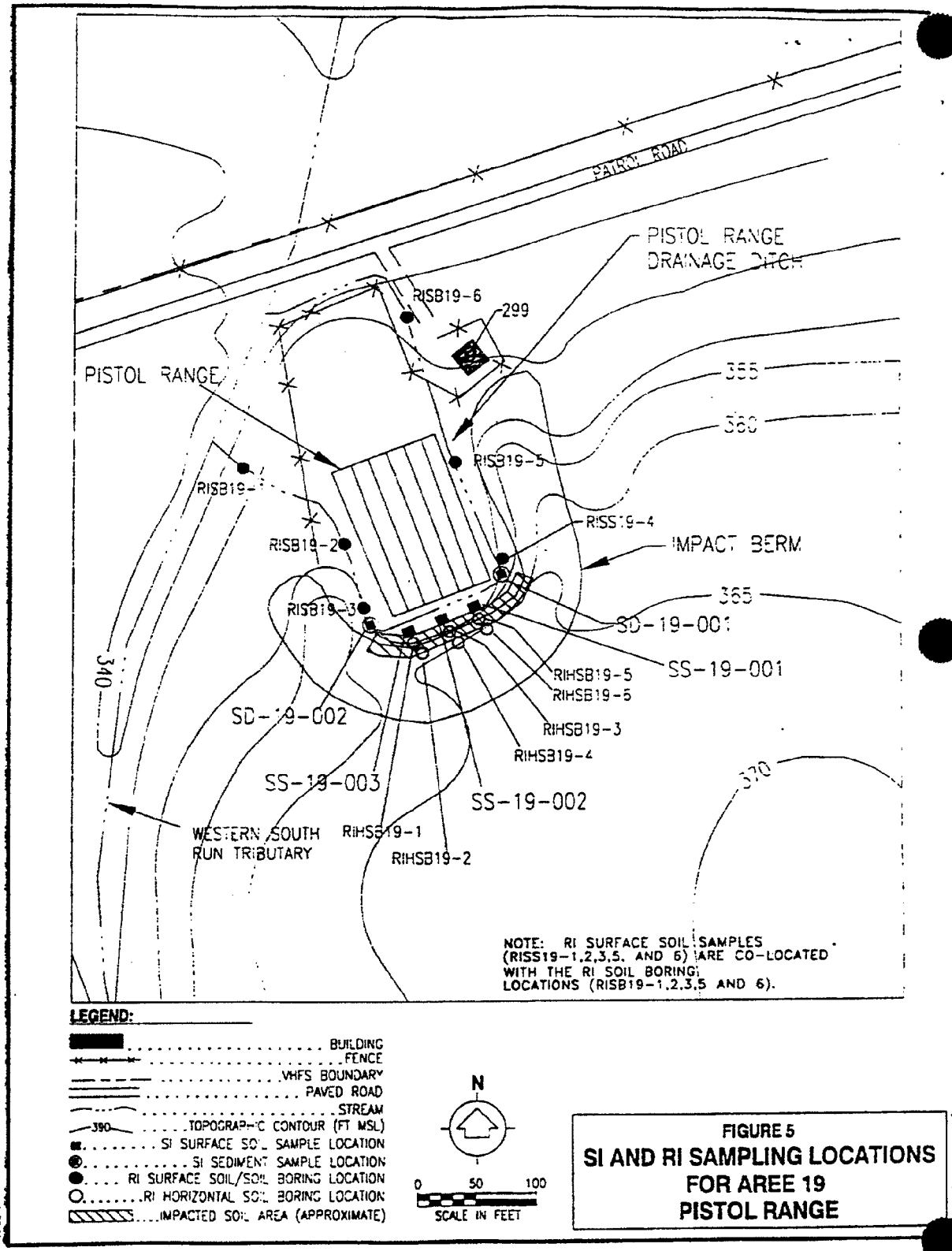


FIGURE 5
SI AND RI SAMPLING LOCATIONS FOR AREE 19 PISTOL RANGE

AREE 21 - Sand Filter Beds

The Sand Filter Beds (AREE 21) were used to filter ash wastewaters from the wet scrubber, which was used for particulate control in the installation incinerator smokestack. The two beds, constructed with concrete walls and an unlined bottom, utilized coarse sand and filter gravel to filter particulates from the wastewater. An underdrain system in the gravel drained the effluent to a distribution box. The effluent then discharged through a perforated pipe to an absorption field north of the Sand Filter Beds.

Surface soil samples were collected from the Sand Filter Beds and along the absorption field. Groundwater samples were collected in the vicinity and downgradient of the Sand Filter Beds and absorption field as shown on Figure 6. Dioxin/furan contamination, exceeding residential soil RBCs, is present in surface soil near the Sand Filter Beds and along the absorption field.

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

A Baseline Risk Assessment (BRA) was conducted as part of the RI to assess the potential human health and ecological problems that could result if the contamination at the AREEs was not remediated. The Human Health Risk Assessment (HHRA) was prepared to evaluate the magnitude of potential adverse effects on human health associated with current and potential future (assuming residential development of the property) exposures to site-related chemicals at the AREEs. The Ecological Risk Assessment (ERA) was conducted to characterize the potential threats to ecological receptors posed by contaminants at the AREEs.

The HHRA follows a four-step process:

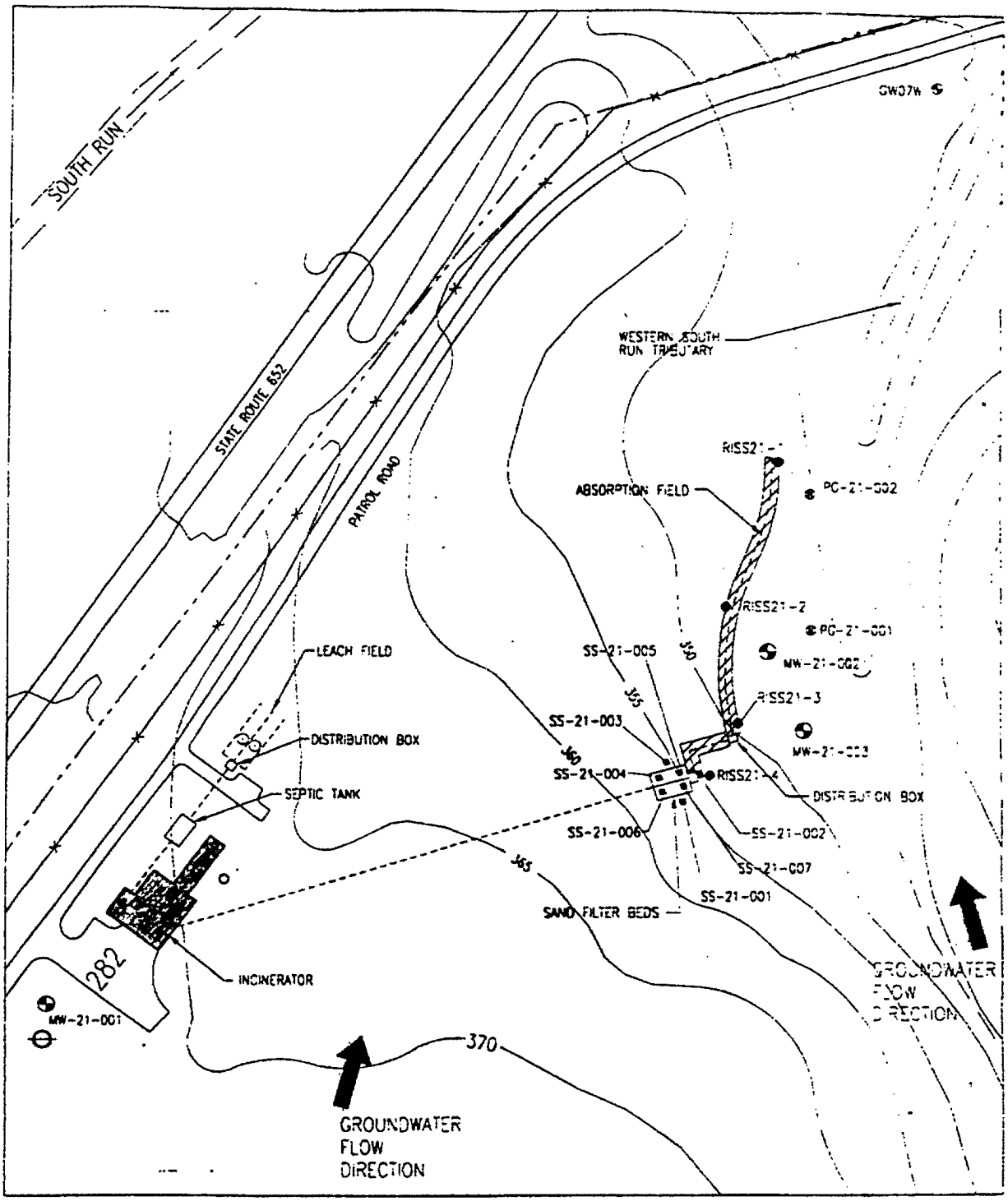
- Selection of Chemicals of Potential Concern - identifies the contaminants of potential concern based on their toxicity, frequency of occurrence, and concentration by comparing the maximum concentrations of detected chemicals with RBCs which are health-protective chemical concentrations that are back-calculated using toxicity criteria, a $1X10^{-6}$ target carcinogenic risk or a 0.1 hazard quotient (defined below), and conservative exposure parameters;

- Exposure Assessment - identifies the potential pathways of exposure, and estimates the concentrations of contaminants to which people may be exposed as well as the frequency and duration of these exposures;

- Toxicity Assessment - determines the toxic effects of the contaminants; and

- Risk Characterization - provides a quantitative assessment of the overall current and future risk to people from site contaminants based on the exposure and toxicity information.

The HHRA evaluated health effects which could result from exposure to soil, groundwater, surface water, and sediment contamination in the Phase I, reuse area of VHFS. The HHRA evaluated potential risks to current workers who could be exposed to contaminants in surface soil, and to current trespassers who could be exposed to contaminants in surface soil, sediment, and surface water. In addition, the HHRA evaluated potential risks to hypothetical future adult and child residents who could be exposed to contaminants in surface soil, groundwater, surface water, and sediment. Potential risks to future excavation workers who could be exposed to contaminants in subsurface soil were also evaluated in the HHRA.



LEGEND:

- BUILDING
- PAVED ROAD
- FENCE
- STREAM
- 380 TOPOGRAPHIC CONTOUR (FT MSL)
- PERFORATED PIPE
- SITE BOUNDARY
- SI SURFACE SOIL SAMPLE LOCATION
- GROUNDWATER MONITORING WELL
- SI GROUNDWATER PUSH SAMPLE LOCATION
- SI DRY PROBE LOCATION
- RI SURFACE SOIL SAMPLE LOCATION
- IMPACTED SOIL AREA (APPROXIMATE)

N

0 50 100 150

SCALE IN FEET

FIGURE 6

SI AND RI SAMPLING LOCATIONS FOR AREE 21 SAND FILTER BEDS

AREE21

Potential carcinogenic (cancer-related) effects and noncarcinogenic effects (including various impacts on different organ systems, such as lungs, liver, etc.) were evaluated in the HHRA. Carcinogenic effects are expressed as the probability that an individual will develop cancer from exposure to the contaminants from each of the AREEs. The evaluation of noncarcinogenic effects is based on the hazard index (HI), which is the summation of the hazard quotients for individual chemicals. The hazard quotient is a comparison of chemical-specif ic chronic exposure doses with the corresponding protective doses derived from health criteria. The USEPA recommends that remedial actions may be warranted at sites where the carcinogenic risk to any person is greater than 1×10^{-4} or the HI is greater than 1. A carcinogenic risk of 1×10^{-4} means that there is a potential of one additional person in a population of 10,000 developing cancer from exposure to contaminants at an AREE if the AREE is not remediated. A HI greater than 1 indicates a potential for noncarcinogenic health effects ff the AREE is not remediated.

The ERA also follows a four-step process:

- Problem Formulation - develops information that characterizes habitats and potentially exposed species and identifies contaminants of concern, exposure pathways, and receptors;
- Exposure Assessment - estimates exposure point concentrations for selected indicator species;
- Ecotoxicologic Effects Assessment - identifies concentrations or doses of contaminants that are protective of indicator species; and
- Risk Characterization - estimates potential adverse effects from exposure to contaminants based on exposure and toxicity information.

The ERA evaluated ecological effects which could result from exposure to surface soil, surface water, and sediment contamination in the Phase I reuse area of VHFS. The ERA evaluated potential adverse ecological effects to terrestrial plants and terrestrial invertebrates exposed to contaminants in surface soil. In addition, potential adverse ecological effects to mammals (represented by shrews) and birds (represented by robins) through bioaccumulation in the food web and exposure to contaminants in surface soil were evaluated. Potential adverse ecological effects to aquatic life from exposure to contaminants in surface water and sediment were also evaluated in the ERA.

The evaluation of significant potential adverse ecological effects is based on the Environmental Effects Quotient (EEQ). The EEQ is the ratio of the estimated exposure concentrations/doses for the chemicals of potential concern and the toxicity reference values (TRVs) for the ecological receptors. If the EEQ is greater than 1, there is a potential for adverse ecological effects to occur. As the magnitude of the EEQ becomes greater than 1, the potential for adverse ecological effects become more significant.

The results of the BRA for the four AREEs are presented in the following paragraphs. A detailed presentation of the BRA can be found in the draft RI Report, now available in the Information Repository at the Fauquier County Library.

AREE 9 - Vehicle Maintenance Area

The BRA determined that contamination at AREE 9 does not pose an unacceptable human health risk or significant potential adverse ecological effects under either current or potential future land-use conditions. In fact, since all the chemicals of potential concern in surface soil identified for AREE 9 in the HHRA are naturally-occurring metals that were statistically determined to be within background concentrations, the estimated upper-bound excess lifetime cancer risks and noncarcinogenic risks for site-related contaminants are less than 1×10^{-6} and a HI of 0.1, respectively. However, risks associated with exposures to TPH could not be assessed in the BRA because this analytical parameter represents a mixture of chemical constituents. Since TPH measurements give no indication of the chemical

constituents present or their respective concentrations, they cannot be used to predict risks. Although risks associated with TPH cannot be estimated, TPH contamination in subsurface soil beneath the Military Motor Pool neutralization pit is recommended for remediation because TPH concentrations exceed the Virginia TPH soil action level for USTs. The impacted area is approximately 3 ft x 3 ft, extending from the base of the neutralization pit at 4 ft below ground surface to bedrock at 8.5 ft below ground surface.

AREE 11 - Former Sewage Treatment Plant

The HHRA concluded that, under current land-use conditions, the risks to workers are unacceptable for exposure to contaminants in surface soil at AREE 11. Under future land-use conditions, assuming that AREE 11 is not remediated, the risks to potential adult and child residents are also unacceptable for exposure to contaminants in surface soil. The highest estimated upper-bound excess lifetime cancer risk is for adult residents exposed to contaminants in surface soil by dermal contact; this risk is $6x10^{-4}$ (i.e., six in 10,000 residents may develop cancer caused by contaminants in the AREE 11 surface soil). The highest non-carcinogenic risk is for child residents exposed to contaminants in surface soil by incidental ingestion and dermal contact; the HI is estimated to be 20 for each of these routes of exposure. The organ systems impacted by noncarcinogenic contaminants at AREE 11 are the liver and kidney. The unacceptable human health risks result primarily from chlordane (a pesticide) and mercury. Although the concentrations of PAHs (specifically benzo[a]pyrene and dibenz[a,h]anthracene) at AREE 11 contribute to the unacceptable risks posed by dermal contact exposure to contaminants in surface soil, they do not drive the unacceptable risks. The highest estimated upper-bound excess lifetime cancer risk for a PAH is $2x\ 10^{-5}$ (two in 100,000 people) for potential future adult residents from dermal contact exposure to benzo(a)pyrene. It should be noted that major uncertainties exist regarding the assessment of dermal contact exposures (particularly associated with dermal absorption factors); therefore, estimated risks are Ilikely to be over-estimated for the dermal contact exposure route.

The ERA determined that contaminants in surface soil at AREE 11 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from DDT (a pesticide), mercury, anc silver. Mercury results in significant potential adverse ecological effects for terrestrial plants, terrestrial invertebrates, robins, and shrews, with the greatest potential adverse ecological effects occurring to robins (EEQ of 573). Silver and DDT result in significant potential adverse ecological effects to terrestrial plants (EEC of 60) and robins (EEQ of 51), respectively.

The most significant contamination is in the sludge pile area, which is recommended for remediation. The impacted area has dimensions of 45 ft in diameter and 0.5 ft deep, with contamination extending to 1.5 ft below ground surface in an isolated location near the center of the sludge pile area. The drying bed area, which has dimensions of 25 ft x 40 ft x 1.5 ft deep, is less contaminated. One isolated surface soil location in the drying bed area (sample location SS-11-004 as shown on Figure 4) is recommended for remediation.

AREE 19 - Pistol Range

The HHRA concluded that, under both current and future land-use conditions, the risks to workers, trespassers, residents, and excavation workers are acceptable for exposure to site-related contaminants. except for possibly lead, in soil at AREE 19. Discounting naturalty-occurring metals that were statistically determined to be within background concentrations, the estimated upper-bound excess lifetime cancer risks from exposure to site-related contaminants in surface soil for all potential receptors and routes of exposure are less than $1x10^{-6}$ the highest noncarcinogenic risk (HI = 0.8) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion. Although the HHRA determined that lead concentrations in surface soil at AREE 19 are below background levels based on statistical comparisons of site and background concentrations, the lead contamination at AREE 19 is known to be site-related. The human health risks associated with exposure to lead in surface soil at AREE 19 were evaluated using the integrated Exposure Uptake Biokinetic (IEUBK) Model recommended by USEPA for evaluating lead exposures for young children in residential settings. The IEUBK Model calculates blood lead levels which result from exposures to lead which may then be compared to blood

lead levels of toxicological significance for purposes of risk evaluation. The IEUBK Model run for AREE 19 predicted a geometric mean blood lead level of 9.6 µg/dL, with 42.7 percent of the population exceeding the level of concern (10 µg/dL). The USEPA currently finds 5 percent of the population exceeding the level of concern as acceptable. Therefore, the IEUBK model results indicate that if AREE 19 was developed for residential use in the future, the lead concentrations in the surface soil may be a potential problem for young children.

The ERA determined that lead in surface soil at AREE 19 poses a significant potential adverse ecological effect for terrestrial plants (EEQ of 117).

The lead contamination in the impact berm surface soil is recommended for remediation. The approximate dimensions of the impacted area are 100 ft x 15 ft high x 2 ft deep.

AREE 21 - Sand Filter Beds

The HHRA concluded that, under both current and future land-use conditions, the risks to workers, trespassers, residents, and excavation works are acceptable for exposure to site-related contaminants in surface soil at AREE 21. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest estimated upper-bound excess lifetime cancer risk ($9x10^{-6}$) is for adult residents exposed to site-related contaminants in surface soil by dermal absorption, and the highest noncarcinogenic risk (HI = 0.2) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion.

The ERA determined that contaminants in surface soil at AREE 21 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from 2,3,7,8-TCDF (a furan). 2,3,7,8- TCDF results in significant potential adverse ecological effects for robins (EEQ of 38).

The primary compound of concern, 2,3,7,8-TCDF, was detected in the absorption field area but not in the Sand Filter Beds themselves. Surface soil along the absorption field is recommended for possible remediation pending establishment of soil cleanup levels. The approximate dimensions of the impacted soil area are 375 ft x 3 ft x 3 ft deep.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. The remedial action objective for the four AREEs is to minimize the potential for contaminated soils to pose unacceptable risks to human or ecological receptors.

CLEANUP LEVELS ESTABILISHED FOR THE PREFERRED ALTERNATIVE

USEPA has established soil cleanup levels for the contaminants that contribute to the unacceptable risk determination at each of the four AREEs. The soil cleanup levels are presented in Table 1. The soil cleanup level for AREE 9 is based on the Virginia TPH soil action level for USTs of 100 ppm. In general, USEPA established the soil cleanup levels for AREE 11 based on either a $1x10^{-5}$ (one in 100,000 people) excess lifetime cancer risk for carcinogens or a hazard quotient of 1 for noncarcinogens, whichever was more stringent, for the potential future residential use scenario. However, the soil cleanup levels for DDT, mercury, and silver at AREE 11 are based on concentrations which are protective of ecological receptors. The soil cleanup level for AREE 19 is based on a level recommended for the protection of ecological receptors by the U.S. Fish and Wildlife Service. The soil cleanup level for AREE 21 is based on concentrations which are protective of ecological receptors. The cleanup level for 2,3,7,8-TCDF $1.12x10^{-4}$ ppm) is higher than the maximum detected concentration at AREE 21 of $8.71x10^{-6}$ ppm; therefore, no further action is required at AREE 21.

Table 1

Cleanup Levels Established for Soils at the Four AREEs

Constituents	Cleanup Levels (ppm)
AREE 9 - VEHICLE MAINTENANCE AREA	
Total Petroleum Hydrocarbons	100 (a)
AREE 11 - FORMER SEWAGE TREATMENT PLANT	
Aldrin (Human Health risk) (b)	0.54 (c)
Cadmiurn (Human Health risk) (b)	78 (c)
Chlordane (Human Health risk)	5 (c)
alpha-Chlordane (Human Health risk) (b)	5 (c)
gamma-Chlordane (Human Health risk) (b)	5 (c)
DDT, (Ecological risk only)	0.26 (d)
Mercury (Human Health & Ecological risk)	029 (d)
Silver (Ecological risk only)	20 (d)
AREE 19 - PISTOL RANGE	
Lead (Human Health & Ecological risk)	200 (e)
AREE 21 - SAND FILTER BEDS	
2,3,7,8-TCDF (Ecological risk only)	1.12×10^{-4} (d)

(a) Virginia total petroleum hydrocarbon soil action level for underground storage tanks.

(b) These compounds contribute to but do not drive unacceptable risk.

(c) Based on either a 1×10^{-5} upper-bound excess lifetime cancer risk for carcinogens or a hazard quotient of 1 for noncarcinogens, whichever is more stringent, for the potential future residential use scenario.

(d) Based on a conceraration which is protective off ecological receptors (EEQ = 10).

(e) Cleanup level for lead in surface soil recommended by the U.S. Fish and Wildlife Service for the protection of ecological receptors.

SUMMARY OF REMEDIAL ALTERNATIVES

Two remedial alternatives were evaluated to address soil contamination at AREEs 9, 11, and 19. As discussed above, no further action is required for AREE 21 based on the established soil cleanup level. The range of remedial alternatives considered was limited by the nature and extent of the contamination. Since the amount of soil requiring remediation is relatively small (less than 300 cubic yards combined), it was not practical to consider active treatment or containment options in terms of cost-effectiveness and implementability. The following remedial alternatives were evaluated:

- Alternative 1 - No Action; and
- Alternative 2 - Soil Removal.

Alternative 1 - No Action

The NCP and CERCLA, as amended by SARA, require that a No Action alternative be considered as a baseline for comparison to other alternatives. No action would be taken to address site contamination under this alternative. In accordance with Section 121 of CERCLA, each AREE would be reviewed at least once every five years to re-evaluate site conditions and to determine the need for remedial action to protect human health and the environment.

Alternative 2 - Soil Removal

Under this alternative, all contaminated soil exceeding the established cleanup levels would be excavated, transported off site by truck, and disposed using a combination of permitted off-site hazardous waste, construction debris, and/or municipal landfills or incinerators, as appropriate based on analytical results. Less than 300 cubic yards of impacted soil would be excavated as part of this alternative, followed by confirmation sampling to assure adequate removal of all soil exceeding the cleanup levels. Upon completion of the soil excavation, disturbed areas would be backfilled, regraded, and either vegetatively stabilized or paved (AREE 9). The five-year review does not apply to this alternative because hazardous substances would not remain on site.

EVALUATION OF ALTERNATIVES

CERCLA requires a comparison of the alternatives using nine evaluation criteria: overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements (ARARs); long-term effectiveness and permanence; reduction of toxic, mobility or volume through treatment; short-term effectiveness; implementability, cost; and regulator and community acceptance. The first two criteria are considered by USEPA to be threshold criteria which must be met by each alternative. The nine evaluation criteria are described below:

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provides grounds for invoking a waiver.

- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health over time, once cleanup goals have been met.

- Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies a remedy may employ.

- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability is the technical and administrative feasibility of a remedy, including trie availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and operation and maintenance costs, and net present worth costs.

- Regulator acceptance indicates whether, based on their review of the RI and Proposed Plan, the regulators (VDEQ and USEPA) concur, oppose, or have no comment on the preferred alternative at this present time.

- Community acceptance will be assessed in the Decision Document following a review of the public comments received on the RI and the Proposed Plan.

The comparative anaiysis of the alternatives was conducted based upon these evaluation criteria, and is described below.

Overaft Protection of Human Health and the Environment

The no action alternative (Alternative 1) is not protective of human health or the environment because the risks to potential future residents and the potential adverse effects to ecological receptors remain unchanged, which is unacceptable. Therefore, the no action afternative was eliminated from further consideration and will not be discussed further.

Alternative 2 provides adequate protection of human health and the environment by removing contaminated soils, thereby eliminating the potential for exposure.

Compliance with ARARs

Alternative 2 has been designed to achieve or comply with ARARS. This alternative will satisfy the established cleanup levels since all soil that is contaminated above applicable cleanup levels will be removed. In addition, the removal and disposition of contaminated soil during implementation of Alternative 2 would be done in accordance with federal and Virginia solid and hazardous waste regulations. During soil excavation, Virginia Regulations for the Control and Abatement of Air Pollution may apply. Ambient air conditions would be monitored during excavation activities to assure acceptable air quality. As necessary based on the ambient air monitoring, water sprays would be used to keep dust levels down.

Long-term Effectiveness and Permanence

Alternative 2 would provide for the permanent removal of contaminated sod to a permitted off-site location designed to prevent contamination migration and exposures to human and ecological receptors.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 provides reduction of contamination at the AREEs by removing contaminated soils. The toxicity and volume of the contaminated soil would not be affected by this alternative; however, the mobility of the contaminants would be reduced because the off-site disposal facilities used would be designed to prevent contaminant migration.

Because treatment of the contaminated soil at the AREES was not found to be practicable due to the small volume of impacted soil, Alternative 2 does not satisfy the statutory preference for treatment as a principal element of the remedy.

Short-term Effectiveness

Alternative 2 is considered to be effective in the short term because the volume of soil to be excavated is relatively small and would result in limited negative impacts to human health or the environment. Dust exposure to workers and adjacent residents would be controlled during excavation activities by water sprays. Prior to excavation operations, temporary erosion control structures would be installed to prevent entry of storm water into the soil excavation areas and prevent erosion and movement of soil from contaminated areas. Although truck traffic would be increased during implementation of Alternative 2, the Implementation period (approximately one month) is short and the number of trucks per day would be less than 20.

Implementability

Alternative 2 is considered readily implementable. Licensed transporters and permitted disposal facilities are currently available.

Cost

The cost to implement Alternative 2 is estimated at $360,000.

Regulator Acceptance

VDEQ and USEPA are currently reviewing this Proposed Plan. VDEQ and USEPA comments will be addressed in the Decision Document.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated at the close of the public comment period by considering both oral and written comments received during the public comment period.

PREFERRED ALTERNATIVE

Alternative 2, Soil Removal, is recommended by the U.S. Army as the preferred alternative for AREEs 9, 11, and 19. No further action is required for AREE 21 based on the established soil cleanup level. This remedial alternative is a permanent solution that offers long-term effectiveness since the contaminated soil is removed to cleanup levels and transported off site for proper disposal. This remedial alternative would be designed to comply with ARARs. The excavation and disposal of contaminated soil would be done in accordance with federal and Virginia solid and hazardous waste regulations. The estimated cost to implement this alternative is $360,000, and the on-site activities would require approximately one month to complete.

Kevin Bell, Public Affairs Officer
Public Affairs Office (Bldg. 101)
Vint Hills Farms Station
Warrenton, VA 20187-5010

U.S. POSTAGE

PUBLIC INVOLVEMENT INFORMATION

The United States Army
at Vint Hill Farms Station, Virginia

Invites Public Comment

ON A PROPOSED ENVIRONMENTAL CLEANUP
Concerning Four Areas
Requiring Environmental Evaluation: 9, 11, 19, & 21

Please Come To Our

• PUBLIC MEETING •

Thursday, September 18, 1997 • 7:00 p.m.*
• Warrenton Middle School Auditorium •
244 Waterloo Street • Warrenton, VA
(*Sign Language Interpreter will be present)

PURPOSE: TO DISCUSS AND PRESENT THE REMEDIAL ALTERNATIVES FOR THE SITES IDENTIFIED ABOVE.

The U.S. Army, in consultation with the U.S. Environmental Protection Agency (USEPA) Region III and the Virginia Department of Environmental Quality (VDEQ), invites public comment on its proposed plan for remediating contaminated soil at the following Areas Requiring Environmental Evaluation (AREEs) on Vint Hill Farms Station (VHFS), Virginia: AREE 9 - Vehicle Maintenance Area; AREE 11 - Former Sewage Treatment Plant; AREE 19 - Pistol Range; and AREE 21 - Sand Filter Beds. Before selecting a final remedy, VHFS will consider all written and oral comments received during the public comment period. •

The U.S. Army will be accepting comments during a
30-DAY PUBLIC COMMENT PERIOD which
begins Thursday, September 11 & ends Friday, October 10, 1997.

WRITTEN COMMENTS MAY BE SUBMITTED TO THE FOLLOWING ADDRESS:

Kevin Bell, Public Affairs Officer
Public Affairs Office (Bldg. 101)
Vint Hill Farms Station
Warrenton, VA 20187-5010

ATTACHMENT 2

CLEANUP LEVEL DEVELOPMENT DOCUMENTS

HUMAN HEALTH RISK-BASED REMEDI ATION GOALS
AREAS REQUIRING ENVIRONMENTAL EVALUATION (AREEs) 11 AND 19
VINT HILL FARM STATION (VHFS)

Risk-based remediation goals for VHFS based on human exposures at the site were calculated for selected chemicals detected in surface soil in areas proposed for remediation (i.e., surface soil at AREEs 11 [Former Sewage Treatment Plant] and 19 [Pistol Range]). Based on a review of the exposure pathways evaluated in the risk assessment, risk-based remediation goals were calculated for chemicals contributing to pathway upper-bound excess lifetime cancer risks greater than $1x10^{-4}$ and/or hazard indices (HIs) greater than or equal to 1. The development of risk-based remediation goals focused on the incidental ingestion exposure pathway only. Although cancer risks exceeding $1x10^{-4}$ were associated with dermal contact exposure to surface soil at AREE 11, risk-based remediation goals did not incorporate exposures through this route due to the great uncertainties associated with assessing dermal exposures. For example, major uncertainties exist in the extent to which chemicals are percutaneously absorbed and in the extent to which chemicals partition from soil to skin leading to uncertainty in the use of default dermal absorption factors in the evaluation of risk. Uncertainties also exist in the use of adjusted oral toxicity criteria to evaluate dermal exposure pathways depending on how closely the factors used to adjust oral toxicity criteria reflect the difference between the oral and dermal routes.

In the VHFS human health risk assessment (HHRA), surface soil incidental ingestion pathways with upper-bound excess lifetime cancer risks greater than $1x10^{-4}$ and/or HIs greater than or equal to 1 were associated with adult and child resident exposures at AREE 11. Therefore, risk-based remediation goals for selected chemicals in surface soil at AREE 11 were developed based on the more conservative residential receptor, consistent with USEPA Region III methodology for calculating risk-based concentrations (i.e., using combined child/adult residential exposure parameters for carcinogenic compounds and using child residential exposure parameters for noncarcinogenic compounds).

Once the relevant exposure media and receptor were identified, risk-based remediation goals were calculated for carcinogenic chemicals associated with chemical-specific risks greater than or equal to $1x10^{-6}$ and noncarcinogenic chemicals contributing to a HI of 1 for a specific target organ. Risk-based remediation goals were not calculated for inorganic compounds that were statistically determined to be within background levels in the risk assessment. For selected carcinogenic chemicals, risk-based remediation goals were developed using a target risk level of $1x10^{-6}$, which is at the low end of USEPA's target risk range for health-protectiveness at Superfund sites. For selected noncarcinogenic chemicals, risk-based remediation goals were calculated to correspond to a target hazard quotient of 1. If any of the noncarcinogenic compounds for which remediation goals were calculated had similar target organs/critical effects, then the risk-based remediation goal for that noncarcinogenic compound was divided by the number of compounds having the same target organ/critical effect (i.e., if two noncarcinogenic compounds had "liver" as the target organ, the individual remediation goals would be divided by two). For chemicals that exhibit both carcinogenic and noncarcinogenic effects (e.g., chlordane), the selected remediation goals represent the lower of the calculated carcinogenic and noncarcinogenic remediation goals.

The following sections present the exposure assumptions and equations used to calculate the risk-based remediation goals for chemicals in surface soil. Table 1 presents the toxicity criteria used to calculate the risk-based remediation goals for chemicals in surface soil.

Surface Soil Risk-Based Remediation Goals

Risk-based remediation goals were calculated for chemicals in surface soil based on combined child/adult resident exposures for carcinogens and on child resident exposures for noncarcinogens for the incidental soil ingestion pathway. The equations and exposure assumptions used to calculate risk-based remediation goals for surface soil are presented below. Equations are presented separately for chemicals exhibiting carcinogenic and noncarcinogenic effects.

TABLE I
CHRONIC ORAL TOXICITY CRITERIA

Chemical	Oral Toxicity Criteria for Carcinogens: Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight-of-Evidence Class (a)	Slope Factor Source	Oral Toxicity Criteria for Noncarcinogens: Chronic Oral Reference Dose (RfD) (mg/kg-day)		Uncertainty Factor (b)	Target Organ/ Critical Effect (c)	Source
Organics								
Aldrin	1.7E-01	B2	IRIS	3E-05		1.000	Liver	IRIS
Chlordane	1.3E+00	B2	IRIS	6E-05		1,000	Liver	IRIS
alpha-Chlordane	1.3E+00	B2	IRIS	6E-05		1.000	Liver	IRIS
gamma-Chlordane	1.3E+00	B2	IRIS	6E-05		1,000	Liver	IRIS
Inorganics								
Cadmium	--	B1	IRIS	1E-03	(d)	10	Kidney	IRIS
Lead	--	B2	IRIS	–		–	CNS	IRIS
Mercury	--	D	IRIS	3E-04		1.000	Kidney	HEAST

(a) USEPA weight-of-evidence classification scheme for carcinogens:
A = Human Carcinogen, sufficient evidence of carcinogenicity in humans;
B1 = Probable Human Carcinogen, limited human data are available;
B2 = Probable Human Carcinogen, sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans;
C = Possible Human Carcinogen, limited evidence from animal studies in the absence of human studies; and
D = Not classified as to human carcinogenicity, inadequate or no evidence.

(b) Uncertainty factors presented are the products of specific uncertainty factors and modifying factors. Uncertainty factors used to develop reference doses generally consist of multiples of 10, with each factor representing a specific area of uncertainty in the data available. The standard uncertainty factors include:
- a 10-fold factor to account for the variation in sensitivity among the members of the human population;
- a 10-fold factor to account for the uncertainty in extrapolating animal data to the case of humans;
- a 10-fold factor to account for the uncertainty in extrapolating from less-than-chronic NOAELs to chronic NOAELs; and
- a 10-fold factor to account for the uncertainty in extrapolating from LOAELs to NOAELs.

Modifying factors are applied at the discretion of the RfD reviewer to cover other uncertainties in the data and range from 1 to 10.

(c) A target organ or critical effect is the organ/effect most sensitive to the chemical exposure. RfDs are based on toxic effects in the target organ or critical effects. If an RfD is based on a study in which a target organ or critical effect was not identified, the organ/effect listed is one known to be affected by the chemical.

(d) For exposures to cadmium in food.

NOTE:
IRIS = Integrated Risk Information System - USEPA,1996.
HEAST = Health Effects Assessment Summary Tables - USEPA, 1995.
-- = No information available.
CNS = Central Nervous System.

The equation used to calculate risk-based remediation goals for chemicals exhibiting carcinogenic effects, using the combined child/adult exposure parameters based on USEPA (1991), is as follows:

$$C_s = \frac{TR * AT_c * 365\ days/year}{EF * IFA * SF_o * 10^{-6}\ kg/mg}$$

where:

C_s	=	chemical concentration in surface soil (mg/kg),
TR	=	target excess individual lifetime cancer risk ($1x10^{-6}$),
AT_C	=	averaging time for carcinogenic effects (70 years),
EF	=	exposure frequency (350 days/year),
IFA	=	adjusted integrated factor (see below) (114.3 mg-year/kg-day), and
SF_D	=	oral cancer slope factor [$(mg/kg\text{-}day)^{-1}$] (see Table 1).

The combined child/adult resident exposure parameters used to calculate carcinogenic risk-based remediation goals for incidental ingestion of surface soil incorporate an age-adjusted factor, which approximates the integrated exposure from birth until age 30 by combining contact rates, body weights, and exposure duration for both children and young adults (USEPA, 1997). The age-adjusted factor was calculated as follows, using exposure parameters from USEPA (1991):

$$IFA = \frac{EDc * IRc}{BWc} + \frac{(EDtot - EDc) * IRa}{BWa}$$

where:

IFA	=	age-adjusted integrated factor (mg-year/kg-day),
ED_c	=	child's exposure duration (6 years),
IR_c	=	child's soil ingestion rate (200 mg/day),
BW_c	=	child's body weight (15 kg),
ED_{tot}	=	total exposure duration (30 years),
IR_a	=	adults soil ingestion rate (100 mg/day), and
BW_a	=	adult's body weight (70 kg).

The equation used to calculate risk-based remediation goals for chemicals exhibiting noncarcinogenic

$$C_s = \frac{THI * BW * AT_{nc} * 365\ days/year}{EF * ED * (1/RfD_o) * 10^{-6}\ kg/mg * IR_{soil}}$$

effects, using the child exposure parameters obtained from USEPA (1991), is as follows:

where:

C_s	=	chemical concentration in soil (mg/kg),
THI	=	target hazard index (1),
BW	=	body weight (15 kg),
AT_{nc}	=	averaging time for noncarcinogenic effects (6 years),
EF	=	exposure frequency (350 days/year),
ED	=	exposure duration (6 years),
RfD_o	=	oral chronic reference dose (mg/kg-day) (see Table 1), and
IR_{soil}	=	soil ingestion rate (200 mg/day).

Summary of Risk-Based Remediation Goals

Risk-based remediation goals for AREEs 11 and 19 were calculated for selected chemicals in surface soil. Specifically, risk-based remediation goals were calculated for all chemicals associated with chemical-specific risks greater than or equal to $1x10^{-6}$ or chemicals contributing to a HI greater than or equal to 1 for a specific target organ for the incidental ingestion exposure pathway. Risk-based remediation goals were not calculated for inorganic compounds that were statistically determined to be within background levels. Risk-based remediation goals for all selected chemicals in surface soil were developed based on conservative child/adult resident receptors for carcinogens and on child resident receptors for noncarcinogens. Risk-based remediation goals for surface soil are presented in Table 2.

Based on a review of the chemicals and pathways evaluated in the risk assessment, risk-based remediation goals for surface soil were calculated for: aldrin, chlordane, alpha-chlordane, gamma-chlordane, cadmium, and mercury detected at AREE 11; and lead detected at AREE 19. At AREE 19, the maximum lead concentration (5,850 mg/kg) was approximately 14 times greater than USEPA's 400 mg/kg residential soil screening level for lead, and the arithmetic mean concentration (949 mg/kg) was approximately twice the screening level. USEPA's residential soil screening level for lead was developed using the Integrated Exposure Uptake Biokinetic (IEUBK) model (USEPA, 1994) and is based on residential exposures by the most sensitive members of the population (i.e., young children). Since a risk-based remediation goal cannot be calculated for lead due to a lack of available quantitative carcinogenic and noncarcinogenic toxicity criteria, the 400 mg/kg residential soil screening level for lead is presented in Table 2 as the remediation goal for lead in surface soil.

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TABLE 2
REMEDIATION GOALS FOR CHEMICALS IN SURFACE SOIL (a)

Chemical	Toxicity Criterion		Calculated Remediation Goal (mg/kg)		Selected Remediation Goal (mg/kg) (d)
	Carcinogenic (mg/kg-day)-1	Noncarcinogenic (mg/kg-day)	Carcinogenic (b)	NoncarcinogenIc (c)	
AREE 11					
Resident Ingestion					
Ardrin	1.7E+01	3E-05	0.038	0.59	0.038
Chlordane	1.3E+00	6E-05	0.49	1.2	0.49
alpha-Chlordane	1.3E+00	6E-05	0.49	1.2	049
gamma-Chlordane	1.3E+00	6E-05	0.49	1.2	049
Cadmium	--	1E-03	--	39	39
Mercury	--	3E-04	--	12	12
AREE 119					
Child Resident Ingestion					
Lead	–	–	--		400 (a)

(a) Remediation goals were calculated for predominant chemicals (i.e., chemicals with risks exceeding $1x10^{-6}$ or chemicals contributing to a HI greater than or equal to 1 for a specific target organ) for the incidental ingestion pathways associated with a total excess lifetime cancer risk exceeding $1x10^{-4}$ or a HI greater tan or equal to 1.

(b) The calculated remediation goals for carcinogenic chemicals were based on a target risk level of $1x10^{-6}$ and were calculated using combined child/adult exposure parameters.

(c) The calculated remediation goals for noncarcinogenic chemicals were calculated using child resident exposure parameters, and were based on a hazard quotient of 1. The remedlation goals for aldrin, chlordane, alpha-chlordane. and gamma-chlordane were divided by four since they all have the liver as the target organ: the remediation goals for cadmium and mercury were divided by two since both have the kidney as the target organ.

(d) The selected remediation goal represents the lower of the calculated carcinogenic and noncarcinogenic remediation goals.

(e) The selected remediation goal is USEPA's residential soil screening level for lead (USEPA, 1994).

ECOLOGICALLY-BASED CLEANUP LEVELS
AREAS REQUIRING ENVIRONMENTAL EVALUATION (AREEs) 11, 19, AND 21
VINT HILL FARMS STATION (VHFS)

Results of the Ecological Risk Assessment (ERA) conducted as part of the Phase I Reuse Area Remedial Investigation (RI) at VHFS (USAEC, 1997) indicate the potential for adverse effects to ecological resources at several on-site locations. Surface soils at AREEs 11, 19, and 21 were identified as having the greatest potential to adversely affect ecological resources and were selected for remediation. The following ecological receptors were identified as having the greatest potential to be adversely affected in each of these areas:

- AREE 11 (Former Sewage Treatment Plant)
  - Terrestrial plants from the presence of silver in surface soil; and
  - Robins from the presence of mercury and DDTr in surface soil.
- AREE 19 (Pistol Range)
  - Terrestrial plants from the presence of lead in surface soil.
- AREE 21 (Sand Filter Beds)
  - Robins from the presence of 2,3,7,8-TCDF in surface soil.

The objective of this document is to identify the reduction in chemical concentrations necessary to be protective of these ecological resources. Because of the conservative nature of the toxicological values and exposure estimates, cleanup levels were derived based on an EEQ[1] of 10. The following sections derive cleanup levels for each of these areas based on the ecological resources at risk.

AREE 11 (Former Sewage Treatment Plant)

Terrestrial Plants

Results of the ERA indicate the potential for adverse effects to terrestrial plants from the presence of silver in surface soil at AREE 11. A literature-based toxicity value of 2 mg/kg derived by Will and Suter (1994) and used in the ERA to evaluate the potential for adverse effects to terrestrial plants was used to derive the cleanup level for silver in surface soil. Using this toxicity value and a target EEQ of 10, the cleanup level for silver in surface soil at AREE 11 is 20 mg/kg.

Terrestrial Wildlife

Results of the ERA indicate the potential for adverse effects to robins from the presence of mercury and DDTr in surface soil at AREE 11. Attachment A outlines the screening model and input parameters used in the ERA to estimate the potential for adverse effects to robins. Assumptions in this model were designed to provide a highly conservative estimate of the potential for adverse effects to robins. One of the most conservative assumptions in the model is that robins would be exposed to the estimated average mercury and DDTr concentrations detected in the VHFS Phase I reuse area (1.14 mg/kg and 0.0918 mg/kg, respectively). However, as discussed in the RI, samples were biased to areas of likely contamination, and samples from these areas are likely to over-estimate actual levels of

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'The Environmental Effects Quotient (EEQ) is the ratio of the estimated exposure concentration/dose for the chemical of concern and the toxicity reference value (TRV) for the ecological receptor of concern.

contamination throughout the facility. Further, the highest mercury and DDTr concentrations were detected within very localized areas of AREE 11. The areas of mercury and DDTr contamination in surface soil at AREE 11 are the sludge pile, which is 45 feet in diameter, and the drying bed, which is 25 feet by 40 feet in size. Mercury and DDTr detected in these areas are the primary drivers of the estimated risks to robins at VHFS. Accordingly, robins are likely to be exposed to mercury or DDTr in only a limited proportion of their total foraging area and, because of the biased sampling methodology, using an average of the Phase I reuse area concentrations detected in surface soil will likely over-estimate the potential for exposure and adverse effects.

Cleanup levels were determined by backcalculating through the risk model used in the ERA. Two approaches were used to develop cleanup levels for robins. The first approach assumes the total area to which robins would be exposed is equal to the entire VHFS Phase I reuse area. This approach is consistent with that used in the ERA and simply requires determining, by backcalculating through the equations presented in Attachment A, an average exposure concentration which is equal to 10 times the toxicity value used in the ERA (i.e., an EEQ of 10). However, this approach is likely to over-estimate risks because it assumes the average Phase I reuse area exposure concentration, estimated by averaging the concentrations of chemical detected at surface soil sample locations, is an accurate indicator of chemical concentrations throughout the Phase I reuse area. The second approach applies a spatial factor to adjust for the area of actual contamination. This latter approach is expected to provide a more realistic estimate of exposure.

The spatial factor used for the second approach was derived by first estimating the total area over which a robin is likely to forage. Pitts (1984) estimated an average territory size of 0.42 hectares (equal to 45,208 square feet) for robins on a college campus in Tennessee. Based on this territory size and the assumption that robins would forage in a roughly circular area around their nests, a robin foraging in AREE 11 could also be exposed to mercury and DDTr in surface soil at AREE 24 (Transformer Storage Area). Although the mercury and DDTr concentrations detected at AREE 24 are lower than those detected at AREE 11, the chemicals detected in AREE 24 could affect the overall potential for adverse effects to robins. Accordingly, cleanup levels for AREE 11 were calculated assuming robins could be exposed to mercury and DDTr at both AREEs 11 and 24. Mercury and DDTr were not detected at any other AREEs within the foraging range of robins at AREE 11.

The total area of potential mercury and DDTr contamination to which a robin foraging at AREE I I could be exposed was estimated to be 2,990 square feet by summing the potentially contaminated areas in AREE 11 (2590 square feet) and the potentially contaminated area in AREE 24 (400 square feet). The proportion of the total foraging area at which a robin associated with AREE 11 could be exposed to mercury or DDTr was then estimated by dividing the estimated total area contaminated with mercury and DDTr by the robin's estimated territory size. Using this approach, a proportion of 0.066 was estimated. This proportion was then used as a multiplier in equations (2) and (5) of Attachment A.

Cleanup levels derived using the approaches described above are presented in Table 1. The approach which accounts for the limited distribution of mercury and DDTr in the territorial range of robins results in higher cleanup levels. However, these cleanup levels are expected to be more realistic and are
recommended for use as the final cleanup levels. Consistent with the ERA, cleanup levels were also derived for both inorganic and organic mercury (methylmercury). Although it is likely only a proportion of the mercury detected in surface soil is present in the organic form, it is recommended that the more conservative methylmercury cleanup level be selected as the cleanup level for AREE 11.

Table 1
Surface Soil Cleanup Levels for the Protection of Terrestrial Wildlife

Chemical	Cleanup Levels Based on Average Site-wide Concentrations (mg/kg)	Cleanup Levels Based on Spatially-Adjusted Estimates of Contamination (mg/kg)	
DDTr	0.018	0.26	(a)
Mercury (inorganic)	0.36	5.19	(a)
Methylmercury	0.02	0.29	(a)
2,3, 7,8-TCDF	2. 9E-06	1. 12E-04	(b)

(a) Cleanup level for AREE 11.
(b) Cleanup level for AREE 21.

AREE 19 (Pistol Range)

Terrestrial Plants

Results of the ERA indicate the potential for adverse effects to terrestrial plants from the presence of lead in surface soil. A literature-based toxicity value of 50 mg/kg derived by Will and Suter (1994) was used in the ERA to evaluate the potential for adverse effects to terrestrial plants. Using this toxicity value and a target EEQ of 10, the cleanup level for lead in surface soil at AREE 19 is 500 mg/kg.

AREE 21 (Sand Filter Beds)

Terrestrial Wildlife

Results of the ERA indicate the potential for adverse effects to robins from the presence of 2,3,7,8-TCDF in surface soil at AREE 21. Attachment A outlines the screening model and input parameters used in the ERA to estimate the potential for adverse effects to robins. Assumptions in this model were designed to provide a highly conservative estimate of the potential for adverse effects to robins. The most conservative assumption in the model is that robins would be exposed to the average of the 2,3,7,8-TCDP concentrations detected in the VHFS Phase I reuse area (1.11E-05 mg/kg). However, as discussed in the RI, the highest 2,3,7,8-TCDF concentration was detected in a very localized area of AREE 21. The area of 2,3,7,8-TCDF contamination in surface soil that is driving the risk to terrestrial wildlife is the absorption bed area of AREE 21 which is approximately 375 feet by 3 feet in size. Accordingly, robins are likely to be exposed to this chemical in only a very limited proportion of their total foraging area, and the use of an average Phase I reuse area exposure concentration will likely overestimate the potential for exposure and adverse effects to robins.

Cleanup levels for 2,3,7,8-TCDF were calculated for AREE 21 using the same methods described earlier to derive cleanup levels for mercury and DDTr at AREE 11. The contaminated proportion of the total territory size was estimated to be 0.025 assuming the contaminated area of AREE 21 is 1,125 square feet in size. Only AREE 21 was factored into the calculation because no other areas of 2,3,7,8-TCDF contamination occur within the range of a robin foraging in AREE 21. The cleanup levels derived for 2,3,7,8-TCDF are summarized in Table 1. It is recommended that the cleanup level derived using the approach which accounts for the spatial distribution of 2,3,7,8-TCDF be used as the cleanup level for AREE 21.

Summary of Cleanup Levels

Table 2 presents the cleanup levels for chemicals of significant ecological concern in surface soil for AREEs 11, 19, and 21. It should be noted that the cleanup level derived for 2,3,7,8-TCDF (1.12E-04 mg/kg) is higher than the maximum detected concentration at AREE 21 of 8.71E-06 mg/kg, indicating that remediation of AREE 21 may not be required when its areal extent is considered.

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Table 2
Cleanup Levels for Chemicals In Surface Soil

Chemical	Cleanup Level (mg/kg)
AREE 11	
DDTr	0.26
Mercury	0.29
Silver	20
AREE 19	
Lead	500
AREE 21	
2,3,7,8-TCDF	1. 12E-04

ATTACHMENT A
ESTIMATION OF ROBIN EXPOSURE TO CHEMICALS FOR THE DERIVATION OF CLEANUP LEVELS

The following sections present the methods used to calculate the potential ingestion low by robins from the ingestion of food (i.e., earthworms) and surface soil. The equations given by were derived based on equations presented by USEPA (1989). Table A-1 presents specific exposure parameter values used in these equations.

Total Dose

The total dietary exposure levels for robins to chemicals was determined using the following equation:

$$Dose_{total} = Dose_{worm} + Dose_{soil} \qquad (1)$$

where:

$Dose_{worm}$ = amount of chemical ingested per day via ingestion of earthworms (in mg/kg bw-d, use equations 2, 3, and 4 to calculate); and

$Dose_{soil}$ = amount of chemical ingested per day from soil (in mg/kg bw-d, use equation 5 to calculate).

Dose From Earthworms

The following equation was used to calculate the dose of chemicals that a robin would be expected to obtain from the ingestion of earthworms:

$$Dose_{worm} = FI * C_{diet} \qquad (2)$$

where:

FI = food ingestion rate (kg/kg bw-d); and

C_{diet} = estimated chemical concentration in diet (in mg/kg, use equation 3 to calculate).

The estimated dietary concentration ($C_{diet)}$) was calculated using the following equation:

$$C_{diet} = P_e * C_e \qquad (3)$$

where:

P_e = proportion of diet consisting of earthworms (unitless); and

C_e = estimated concentration of chemical in earthworms (in mg/kg, use equation 4 to calculate).

Table A-1
Summary of Exposure Parameters Used In the Robin Food Ingestion Model

Parameter	Value	Source
Food ingestion rate (FI; kg/kg bw-d)	1.52	a
Proportion of diet consisting of earthworms (P_e; unitless)	0.18	b,c
Bioconcentration factor for chemical in earthworms (BCF; unitless)	DDTr = 1.4 inorganic mercury = 0.96 methylmercury = 27 2,3,7,8-TCDF = 14.5	d,e f g h
Soil ingestion rate (SI; kg/kg bw-d)	0.158	i

(a) Hazelton et al. (1984) as cited in USEPA (1993).
(b) Wheelwright (1986) as cited in USEPA (1993).
(c) Howell (1942) as cited in USEPA (1993).
(d) Beyer (1990).
(e) Tyler (1973).
(f) Beyer and Stafford (1993).
(g) Eisler (1987).
(h) Eisler (1986).
(i) Beyer et al. (1994).

The concentration of chemical in an earthworm (C_e) fresh weight was determined using the following equation:

$$C_e = C_{soil} * BCF \qquad (4)$$

where:
C_{soil} = average concentration of chemical detected in surface soil (mg/kg): and
BCF = bioconcentration factor for chemical in earthworms (unitless).

Dose From Soil

The following equation was used to calculate the dose of chemicals that a robin would be expected to obtain from the ingestion of surface soil:

$$Dose_{soil} = SI * C_{soil} \qquad (5)$$

where:
SI = soil ingestion rate (kg/kg bw-d); and
C_{soil} = average chemical concentration in surface soil (mg/kg).

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ATTACHMENT 3

PUBLIC NOTICE

The United States Army
at Vint Hill Farms Station, Virginia

Invites Public Comment

ON A PROPOSED ENVIRONMENTAL CLEANUP
Concerning Four Areas
Requiring Environmental Evaluation: 9, 11,19 & 21

Please Come To Our

PUBLIC MEETING

Thursday, September 18, 1997 7:00 p.m.*
Warrenton Middle School Auditorium
244 Waterloo Street • Warrenton, VA
(*Sign Language Interpreter will be present)

PURPOSE: TO DISCUSS AND PRESENT THE REMEDIAL ALTERNATIVES FOR THE SITES IDENTIFIED ABOVE.

The U.S. Army, in consultation with the U.S. Environmental Protection Agency (USEPA) Region III and the Virginia Department of Environmental Quality (VDEQ), invites public comment on its proposed plan for remediating contaminated soil at the following Areas requiring Environmental Evaluation (AREEs) on Vint Hill Farms Station (VHFS), Virginia AREE 9 - Vehicle Maintenance Area, AREE 11 - Former Sewage Treatment Plant, AREE 19 - Pistol Range, and AREE 21 - Sand Filter Beds. Before selecting a final remedy, VHFS will consider all written and oral comments received during the public comment period.

The U.S. Army will be accepting comments during a 30-DAY PUBLIC COMMENT PERIOD which begins *Thursday, September 11 &* ends *Friday, October 10, 1997.*

WRITTEN COMMENTS MAY BE SUBMITTED TO THE FOLLOWING ADDRESS:

Kevin Bell, Public Affairs Officer
Public Affairs Office (Bldg. 101)
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BACKGROUND

VHFS is part of the U.S. Army Communications - Electronics Command (CECOM) and primarily functions as an Army installation engaged in communications intelligence. VHFS is located approximately 40 miles southwest of Washington, DC, Fauquier County Virginia. The installation occupies approximately 701 acres of land near the town of Warrenton, Virginia. Approximately 150 acres of the installation are improved grounds in the southern portion of the property used for industrial operations, administration buildings, and residential housing. Approximately 94 acres on the eastern portion of the property are mature hardwood forest, and the majority of the remaining 457 unimproved and semi-improved acres in the northern portion of the property are used for stationary and mobile antenna operations sites. The facility was designated for closure in March, 1993, under the Base Realignment and Closure (BRAC) Act.

PROPOSAL

VHFS evaluated two remedial alternatives to address soil contamination at AREEs 9, 11, and 19 *

ALTERNATIVE 1: No Action; and
ALTERNATIVE 2: Soil Removal

Based on available information, VHFS prefers Alternative 2 which includes excavation and off-site disposal of contaminated soil for AREEs 9, 11, and 19. This remedial alternative is a permanent solution that offers long-term effectiveness since the contaminated soil is removed to cleanup levels and transported off site for proper disposal. Since the amount of soil requiring remediation is relatively small (less than 300 cubic yards combined), it was not practical to consider active treatment or containment options in terms of cost-effectiveness and implementibility. The excavation and disposal of contaminated soil would be done in accordance with federal and Commonwealth of Virginia solid and hazardous waste regulations.

*Based on the soil cleanup levels established by USEPA for the protection of human health and the environment, no further action is required for AREE 21.

FOR MORE INFORMATION

You can review the Proposed Plan and related technical documents at the information Repository at the following location:

Fauquier County Library
Warrenton Branch - Reference Section
11 Winchester Street
Warrenton, VA 22186

Hours:
M-W 10 a.m. - 9 p.m.,
Th-Sat 9 a.m. - 5 p.m. and
Sun 1 p.m. - 5 p.m.
Phone: (540) 347-8750